

## **Systems Reference Library**

# **IBM 1410/7010 Operating System Generalized Sorting Program Using IBM 1301/2302 Disk Storage-1410-SM-972**

This publication provides information necessary for utilization of the Generalized Sorting Program Using IBM 1301/2302 Disk Storage, a component of the 1410/7010 Operating System. The generalized program consists of: (1) a set of subroutines from which the user can create different sorting programs that use disk storage for intermediate work files; and (2) a separate routine called the Sort Definition Program. From information contained in parameters supplied by the user, the Sort Definition Program selects the required subroutines. The resulting sort program(s) functions under control of the System Monitor and utilizes the Resident rocs. At object time, the sort program created alters itself, via control card information, to fit the requirements of the particular application.

The IBM 1302 Disk Storage Unit is now designated the IBM 2302 Disk Storage Unit; there has been no change in the unit itself, in the applications for which the unit may be used, or in the programming parameters used to specify those applications. The IBM 2302 Disk Storage Unit designation has been used in the text of this publication; programming parameters and table references remain unchanged and refer to 1302.

MAJOR REVISION (July 1965)

This publication is a major revision of *IBM 1410/7010 Operating System, Generalized Sorting Program Using IBM 1301/1302 Disk Storage*: Form C28-0404-0, and makes that publication and its associated Technical Newsletter (N27-1206) obsolete. References to the IBM 1302 Disk Storage Unit have been changed to reflect its redesignation as 2302 Disk Storage Unit. These and other minor changes not previously published are indicated by a vertical line at the left of the affected text; figure changes are indicated by a bullet (●) at the left of the figure caption.

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IBM Corporation, Programming Systems Publications, Department 637, Neighborhood Road, Kingston, New York 12401

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### Purpose of the Publication

This publication provides the IBM 1410/7010 Operating System user with information on the procedures necessary for implementing the Generalized Sorting Program Using IBM 1301/2302 Disk Storage. The main sections of the publication and their scope are as follows: the "Introduction" and "Features and Specifications" sections aim to familiarize the user with the program and its capabilities; the "Program Definition" and "Program Operation" sections provide instructions on how to define and produce absolute disk sort programs, and how to execute them; and the "Program Description" and "Program Modification" sections describe the functions of the phases of the created programs, and provide information necessary for the user if he wishes to include his own added programming.

### Purpose of the Program

The generalized program, hereinafter referred to as the Generalized Disk Sorting Program, provides the user with the capability of producing in executable format the disk sorting programs necessary for handling his installation's requirements. The program consists of two parts, which interact to accomplish this function. The two parts are: (1) the set of subroutines from which the user can create different sorting programs; and (2) the Sort Definition Program, the routine that performs the selection of the required subroutines. At object time, the program to be run, acting upon control card information provided by the user, alters itself to meet the requirements of the particular application.

Programs with varying combinations of the following characteristics can be produced: magnetic tape, disk, or Standard Input Unit (siu) input; magnetic tape or disk output; processing fixed-length records or variable-length records; sorting on multiple or single control data fields; unmodified or containing modifications. Every program produced, however, will utilize disk storage for work files during the sort.

### Prerequisites

The reader of this publication should have experience in programming either the 1410 or 7010 Data Processing System, and should possess an understanding of basic sorting techniques. He should also be familiar with the information contained in the following publications:

*Sorting Methods for IBM Data Processing Systems*, Form F28-8001

*IBM 1410/7010 Operating System; Basic Concepts*, Form C28-0318

*IBM 1410/7010 Operating System; System Monitor*, Form C28-0319

*IBM 1410/7010 Operating System; Basic Input/Output Control System*, Form C28-0322

*IBM 1301, Models 1 and 2, Disk Storage, and IBM 2302, Models 1 and 2, Disk Storage with IBM 1410 and 7010 Data Processing Systems*, Form A22-6788

Additional information on the disk Sort Definition Program can be found in the publication, *IBM 1410/7010 Operating System; System Generation*, Form C28-0352.

### Machine Requirements

The minimum core-storage, disk-storage, and channel requirements for the Generalized Disk Sorting Program can be found under "Equipment Requirements" in the "Features and Specifications" section. The over-all machine requirements for the Operating System can be found in the publication *System Generation*.

### Terminology

A glossary in this publication defines all sorting terms as they are used in describing this program. Definitive descriptions of such terms as ASGN and CALLN cards; and /MCR/, /UEP/, and /IP1/ fields, etc., can be found in the publication *System Monitor*. Terms such as SC1 and SC mode are defined in the publication *System Generation*. Definitions and descriptions of iocs terms such as File Table, File Table Extension, iorw, Form A disk file, Form C disk file, Form G disk file, etc., are contained in the publication *Basic Input/Output Control System*.

## General Description

### Organization of the Generalized Program

As a component of the 1410/7010 Operating System, the Generalized Disk Sorting Program functions under control of the System Monitor and utilizes the Resident iocs. The generalized program is provided to Operating System users as part of the Relocatable Library, a section of the IBM-supplied Master file.

On the Master file, the Generalized Disk Sorting Program exists in two parts: the first part is the set of relocatable sort subroutines, and the second part is the disk Sort Definition Program.

This Sort Definition Program, which can be converted to absolute format during system generation or during the day's processing, has as its function the selecting of those sort subroutines required to form the type of sort program(s) desired by the user. The sort subroutines, known collectively as the Sort Subroutine Library, may at system generation be included on the System Library file.

Execution of the Sort Definition Program and conversion of the selected subroutines to absolute format can be performed at system generation or during the day's processing. The entire process of producing executable sort programs, from the time the program is defined to object time, occurs in two main steps:

1. The user supplies the Sort Definition Program with parameters that enable it to select those subroutines necessary for the type of sort program desired. An installation can create several different sort programs. Statements specifying the subroutines required are written on symbolic unit MW2, which can serve as input to the Linkage Loader. The Linkage Loader then produces the sort program(s) in absolute but not final format.

2. At object time, the sorting program, acting upon control-card information supplied by the user, alters itself to meet the requirements of the specific application, and is thus in executable format.

Figure 1 illustrates one way in which a sorting program can be created.

### Phases of the Created Sort Programs

Each sort program produced will convert an input file of data records into an ordered output file, in accordance with control card specifications. To perform this

process, each program is divided into three primary phases. A General Assignment Phase, which precedes these three phases, performs the initial housekeeping for the sort program.

Phase 1 performs an internal sort that arranges the tape, disk, or card input records into ordered sequences on disk. Phase 2, when required, performs a series of disk-to-disk merges on the sequences created in Phase 1. Phase 3 performs the final merging pass, and produces a single sequence of data records on disk or tape.

An explanation of the processing within each phase can be found in the "Program Description" section.

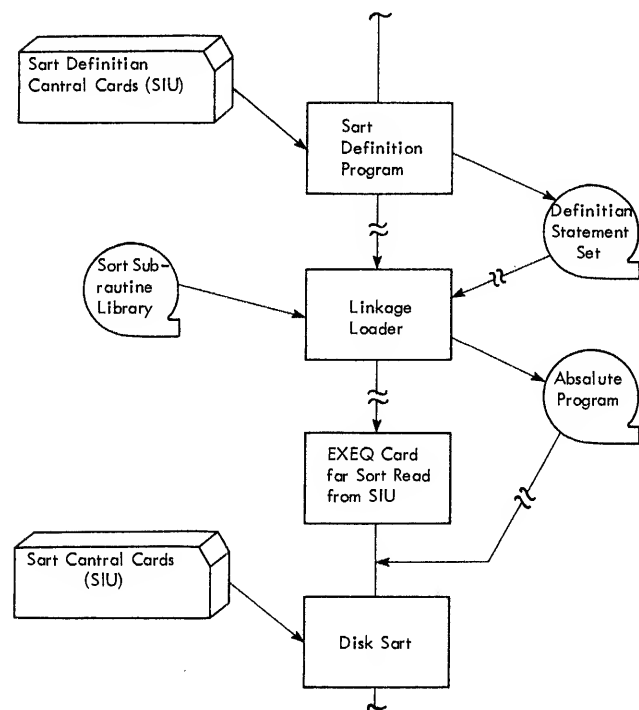


Figure 1. Creating a Sort Program

### Program Features

The Generalized Disk Sorting Program provides the Operating System user with many advantages in the areas of acceptable input/output media and formats, designation of work file space, length and number of control data fields, incorporation of added programming, and error-checking for disk-write operations.

The input file for a created sort program may be on any specified magnetic tape units, on any specified disk areas in 1301 or 2302 Disk Storage, or in card form on the *SVU*. In the case of tape or disk, the user indicates the medium containing the input file via the Sort Definition control card. If the input file resides on the *SVU*, the user proceeds at Sort Definition as though he were defining a modified sort program that will process fixed-length records; at object time he designates *SVU* on a sort program control card (see *INPBLKNG* parameter, *INPUTFILE* control cards, in the "Program Operation" section).

The device(s) containing the input file may be on any channel; this facilitates program scheduling within the Operating System. If the input file is on magnetic tape, it may be in odd or even parity. The input from tape or disk may be blocked or unblocked fixed-length records, or blocked or unblocked variable-length records. *SVU* input can be used by the sort only as fixed-length records.

Output of the sort program can be to disk or tape units on any channel; the user specifies on the Sort Definition control card the medium (tape or disk) that will contain the output file. The output medium need not be the same as the input medium (e.g., disk input-tape output, tape input-disk output). With disk output, the count of the disk records in the output file will be placed in the */IFI/* field (see *System Monitor*) in the Resident Monitor; this information may thus be used by the following program within the job.

For the series of disk-to-disk merges that constitutes Phase 2, the program will use the disk work areas specified by the user. The blocking used during this phase is independent of the blocking of the input file, the blocking of the output file, and the number of records internally sorted at one time.

The control data word upon which the program is based can consist of as many as ten control data fields. Maximum length for any single control data field is 999 characters. The control data fields can be contiguous or may be scattered throughout the record; however, they must not overlap.

User-written subroutines can be incorporated into each phase of the disk sort program. The "Program Modification" section describes how to determine the amount of core storage available for added programming in each phase. To include added programming, the user must activate an exit point; the generalized program provides the user with the capability of activating exit points at logical junctures in the program he is creating. The three phases in which exit points are available are the General Assignment Phase, Phase 1, and Phase 3. If the user specifies, via a Sort Definition control card entry, that added programming will be included, his routines will be inserted as in-line coding at the exit point specified on the *TITLE* or *CALLN* card for those routines. Linkage symbols enable the user to refer to portions of the program needed for the successful execution of his added routines. The non-sorting type functions performed by the added routines can include alteration, addition, deletion, summarization, expansion and contraction of data records, and the activation of *IOCS* tape-label and error exits.

The sort program(s) produced will sort in ascending or descending order, with the collating sequence based on the standard *BCD* Interchange Code. The user can specify via a sort program control card entry that the descending order be employed; otherwise, the sort will be in ascending order.

The user will have the option of incorporating the Write Disk Check feature in the sort program(s). Inclusion of this method of checking data written on disk can be specified by a sort program control card entry.

The option of having checkpoints taken can be indicated via a sort program control card. These checkpoints, which are written on the Core Image file (*MDM*), are taken by means of the Resident *IOCS* checkpoint routine. Restart procedures are provided by the System Monitor.

### Equipment Requirements

#### Basic Machine Requirements

Operation of the Generalized Disk Sorting Program requires either: an IBM 1410 with 60,000 or 80,000 positions of core storage and the Processing Overlap and Priority features; or an IBM 7010 with 60,000, 80,000, or 100,000 positions of core storage.

The sort program(s) created by the Sort Definition

Program can use 1301 or 2302 Disk Storage for work files. The program(s) can operate with only one module of 1301 Disk Storage; however, to achieve optimum efficiency, two 1301 modules are required. With the 2302, full efficiency can be obtained with one module; the two work areas must be positioned such that each access mechanism will service one of the work areas. Two modules of 2302 Disk Storage, each containing one work area, will, of course, also provide optimum efficiency. The format required for the disk work areas is described under "Disk Work Space and Format Requirements" in this section. The number of disk cylinders required depends on the particular application and can be ascertained by consulting the timing tables in the Appendix.

When two data transmission channels are used (each connecting one or more of the 1301 or 2302 modules to the 1411 or 7114 Processing Unit), the sort program will automatically overlap reading and writing operations wherever possible.

A description of the equipment requirements for the entire Operating System can be found in the publication *System Generation*.

#### Use of Magnetic Tape Units

If the input to the sort resides in disk storage or on the sru, no magnetic tape units for input are required. If the output from the sort is to be placed on disk, no magnetic tape units for output are required. Tape units for either input or output may be any of the following: IBM 7330, 729 II, 729 IV, 729 V, and 729 VI. If tape units are used for input and/or output, the requirements are as follows:

Input Tape Unit(s) (Not required if the input is on disk or on the sru)	One, for one reel of input; one or more (on any channel) for two or more reels of input. This unit(s) may also be used for output.
Output Tape Units(s) (Not required if the output is to be written on disk)	One, for one reel of output; one or more (on any channel) for two or more reels of output. This unit(s) may also be used for input.

These tape units would be in addition to the minimum number required for the user's Operating System. The user must also remember that the Sort Definition Program uses the tape unit assigned to symbolic unit MW2 for its output; this output is later used as input to the Linkage Loader.

#### Input/Output Specifications

##### Blocking Considerations

The maximum block length for magnetic tape input is 9,999 characters; the same figure applies for magnetic tape output. Maximum blocking factor for tape or

disk input and output is 999. The minimum permissible input/output tape or disk record length is 13 characters.

If the input file is on 1301 Disk Storage, the maximum input block length is 2,800 characters; for 2302 input, the maximum input block length is 5,850 characters. The same figures apply for 1301 and 2302 output, respectively.

Under normal circumstances, there will be sufficient core storage available to accommodate, in each of the two necessary Phase 3 output areas, a block of the maximum length that can be specified. The sort program will not alter the user's output block length specification; it will utilize a Phase 3 merge order consistent with the amount of core storage available. However, if the user's over-all core-storage requirements are such that the output block length specified cannot be accommodated in Phase 3 even with a minimum merge order, the sort will not be able to proceed. Too much added programming in Phase 3, and/or the presence of a Tele-processing system, may have contributed to the sort program's inability to provide the necessary amount of core storage for the specified output block length. In this case, an "Insufficient Core Storage in Phase 3" message will be issued. The user must then reduce the size of the routines sharing core storage with Phase 3, or reduce the Phase 3 core-storage requirements by reducing the output block length, and re-execute the program.

##### Input Specifications

Input to a created sort program may be in the form of blocked or unblocked fixed-length records, or blocked or unblocked variable-length records. The input file may be on either tape, cards, or disk. There must be at least one input data record.

##### Input Data Record Lengths

For records ending in a record mark, the maximum data record length that the sort can accept and process is 2,800 characters. For records that do not end in a record mark, the maximum data record length is 2,799 characters. The minimum data record length for variable-length records is 13 characters. These figures apply for both tape and disk input; card input is fixed at 80 characters.

The data record length specified must include the record mark and Record Character-Count, if either or both are present. The RECLen parameter in the SORTTYPE sort program control card (see "Program Operation") specifies the data record length as processed by the sort.

If a record mark will be added on output, the data record length specified in the RECLen parameter must reflect the presence of the record mark. In this case, the



input LENMODREC parameter in the INPUTFILE control card (see "Program Operation") must specify the length of the input data record; the sort program will take the input data record length from this parameter. These procedures must be followed if either: (1) the input is unblocked without record marks and the output is to be blocked; or (2) the input is unblocked without record marks and the output is to be unblocked with record marks.

If the record mark will be deleted on output, the data record length specified in the RECLLEN parameter must reflect the presence of the record mark. In this case, the output LENMODREC parameter in the OUTPUTFILE control card (see "Program Operation") must specify the length of the output data record; the sort program will take the output data record length from this parameter. These procedures must be followed if either: (1) the input is blocked and the output is to be unblocked without record marks; or (2) the input is unblocked with record marks and the output is to be unblocked without record marks.

If the input or output data record lengths are not changed by user-written modification routines, the only situations in which the user will not need to include the input or the output LENMODREC parameters

are: (1) the input is blocked and the output is to be blocked; (2) the input is unblocked without record marks and the output is to be unblocked without record marks; (3) the input is unblocked with record marks and the output is to be blocked; (4) the input is blocked and the output is to be unblocked with record marks; and (5) the input is unblocked with record marks and the output is unblocked with record marks. In these cases, the sort program will use the data record length specified in the RECLLEN parameter as the data record length for input and output.

Figure 2 illustrates the use of the RECLLEN and LENMODREC parameters. The input data record length is assumed to be 80 or 81 characters, depending on the absence or presence of the record mark.

#### Input Data Record Formats

Input data records must meet the specifications for the particular record form designated by the user in his sort program control card entries. The requirements for each of the acceptable record forms are detailed in the publication *Basic Input/Output Control System*. Form 3 records, however, must not be designated as such by the user; he can process records in this form by defining them to the sort as Form 1 or Form 4 records.

Input Description	Output Description	Input DRL*	Sort DRL*	Output DRL*	Parameters Used for Specifying DRL*
Unblocked,** without record marks	Unblocked, without record marks	80	81	80	RECLLEN-80
Unblocked,** without record marks	Unblocked with record marks	80	81	81	RECLLEN-81 LENMODREC-80 (in INPUT-FILE card)
Unblocked, with record marks	Unblocked without record marks	81	81	80	RECLLEN-81 LENMODREC-80 (in OUTPUT-FILE card)
Unblocked,** without record marks	Blocked	80	81	81	RECLLEN-81 LENMODREC-80 (in INPUT-FILE card)
Blocked	Unblocked, without record marks	81	81	80	RECLLEN-81 LENMODREC-80 (in OUTPUT-FILE card)
Unblocked, with record marks	Unblocked, with record marks	81	81	81	RECLLEN-81
Blocked	Blocked	81	81	81	RECLLEN-81
Unblocked, with record marks	Blocked	81	81	81	RECLLEN-81
Blocked	Unblocked, with record marks	81	81	81	RECLLEN-81

\* DRL -- Data Record Length

\*\* Magnetic tape or SIU only

Figure 2. Data Record Length Specification as Influenced by the Presence or Absence of Record Marks

An additional requirement exists for Form 1 records in *disk storage*: in order for the file to be acceptable as input to the sort, each record must end in a record mark.

The sort program(s) will accept data records containing any valid 1410/7010 standard BCD Interchange Code characters, with the following restrictions:

1. A record mark can only appear as the last character of a record.
2. Group marks must never appear in a record.

#### **Magnetic Tape Input**

The user can create, through the Sort Definition Program, sorting programs that utilize magnetic tape input. The tape input files may be in even or odd parity. The program(s) will accept input recorded in either the Move mode or the Load mode. In either case, the sort will read the records in the Move mode; each word separator on tape will be read into core storage as a word separator character.

Input that has been recorded in the Move mode can contain records in any one of the standard record forms. However, if the input has been recorded in the Load mode, only Form 1, Form 2, and Form 3 (defined as Form 1) records are acceptable to the sort program. *Blocked, variable-length records (Form 4) that have been recorded in the Load mode are not acceptable as input to the sort.*

If the input consists of fixed-length records (i.e., Form 1 fixed-length, Form 2, or Form 3 fixed-length records) that have been written in the Load mode, all word separator characters must be in the same relative position on each data record; sort program control card entries that define data record length and control data fields must reflect the presence of the word separator characters.

If the input file consists of unblocked, variable-length records (i.e., Form 1 or Form 3 variable-length records) that have been written in the Load mode, the control card entries defining maximum data record length and control data fields must also reflect the presence of word separator characters. In records of these types, the word separator characters that precede the rightmost defined field (which may be either a control data field or a Record Character-Count field) must be located in the same relative position on each data record; word separator characters following the rightmost defined field are unrestricted as to the number and location.

#### **Disk Input**

Disk input to the sort program(s) must consist of data recorded in the Move mode. The records will be read by the program in the Move mode. Either of two input methods can be used:

1. The Full Track without Addresses method
2. The Single Record method

The first method uses the Read Full Track without Addresses instruction and is carried out by iocs routines for Form A (Sequential-Full Track) disk files (see *Basic Input/Output Control System*). Since the disk records will be deblocked according to the input blocking factor specified in the sort program control cards, any desired Move-mode disk format is acceptable to the sort, provided the format is consistent with the specified data record length and input blocking factors. However, the most efficient formats (using the Full Track without Addresses method) for reading input to the sort are: (1) one 2,800-character disk record per track for the 1301; and (2) one 5,850-character disk record per track for the 2302.

The second method uses the Read Single Record instruction and can be carried out by either the iocs routines for Form C (Sequential-Geometric) disk files, or the iocs routines for Form G (Partitioned Sequential-Geometric) disk files (see *Basic Input/Output Control System*). If Form C disk files have been specified for input, the program is set up for two disk records per track, requiring record addresses 00 and 01. If Form G disk files have been specified, the program is set up to read record 00.

The input read using this method can consist of blocked data records, provided the disk records are consistent with the data record length and input blocking factor specified in the sort program control cards.

**Disk Input End-of-File:** If the input file is in disk storage, and the user has provided the sort program with the input block count, the program will base its determination of the input end-of-file on this information. The input block count (i.e., number of disk records in the input file) can be specified via the optional IBLCKCOUNT parameter on the INPUTFILE sort program control card (see "Program Operation"). If this number has been left in the Resident Monitor /IPI/ field by a preceding program, the user can utilize the IBLCKCOUNT parameter to indicate that the information be obtained from that field. This is done by specifying IPI as the IBLCKCOUNT parameter value, instead of the actual number.

If the input block count is not provided by the user (i.e., the IBLCKCOUNT parameter is not used), determination of input end-of-file will be based on the recognition by the iocs of the last track address of the last input-file disk area.

#### **Sort Capacity**

The capacity of the disk sort is dependent on the amount of disk work space provided by the user. To achieve the greatest sort capacity, no more than 9,999 tracks should be defined as the disk sort work area.

NOTE: A full module (10,000 tracks) must never be defined as a work area. The timing tables or formulas in the Appendix of this publication can be used to determine the number of cylinders required; this figure is based on the core storage size, input file size, and data record length.

#### SIU Input

The user can specify at object time, via the INPBLKNG parameter on the INPUTFILE sort program control card, that the input to the disk sort will be from the SIU. The sort, however, can accommodate SIU input only if: (1) the program has been defined as modified; and (2) the program has been defined as processing fixed-length records. Any other parameters from the alternative sets (see "Program Definition") may also be on the Sort Definition control card.

Designation of the MOD (for modified) parameter on the Sort Definition control card results in the creation of an input area for records coming into Phase 1; this area is necessary for Phase 1 input. The user must also make some symbolic unit designation for the input file parameter on the Unit Definition card; in this case, no physical units need be assigned to this symbolic unit.

With SIU input designated, the user's input file can be either in card form or, if the SIU is on tape, in card image form.

#### Output Specifications

The output from a sort program may be on any specified tape unit(s) or disk area(s). Output records are subject to the same requirements for form, content, and length that apply to input records. However, the user can select the desired output format from the several which are possible for each respective input format. Permissible combinations of input/output formats are summarized in Figure 3.

#### Output Data Record Formats

The output blocking factor is independent of the input blocking factor and the sort blocking factor. The maximum block lengths for tape and disk output are discussed under "Blocking Considerations."

Blocked, fixed-length records may be specified as output from a sorting application in which the input consists of unblocked, fixed-length records. If the input data records do not end in a record mark, the sort program will automatically place a record mark in the last position of each data record.

Unblocked, fixed-length records may be specified as output from a sorting application in which the input consists of blocked, fixed-length records. The sort program will delete the record mark on output.

Unblocked, variable-length records, either with or without record marks, may be specified as output

		Output Forms					
		Form 1		Form 2	Form 3		Form 4
		Fixed	Variable		Fixed	Variable	
Input Forms	Form 1 Fixed	Yes		Yes			
	Form 1 Variable		Yes				Yes**
	Form 2	Yes		Yes			
	Form 3 Fixed	Yes*		Yes*	Yes*		
	Form 3 Variable		Yes#			Yes*	Yes#
	Form 4		Yes				Yes

\* Must be handled as Form 1 records.

\*\* Input records must have Record Character-Counts.

# Must be handled as Form 4 records. The input records must have record marks and Record Character-Counts.

Figure 3. Permissible Combinations of Input/Output Record Formats

from a sorting application in which the input consists of blocked, variable-length records. If the output records are not to contain record marks, the sort program will delete the record marks on output.

Blocked, variable-length records may be specified as output from an application in which the input consists of unblocked, variable-length records; in this case, however, the input data records must contain Record Character-Counts. If the input data records do not contain record marks, the sort program will add a record mark to each data record.

The effect of record marks on the specification of data record lengths is discussed under "Input Data Record Lengths."

The sort program will in no case alter the contents of a Record Character-Count field. Any such changes necessitated by the specification of an output format different from the input format must be accomplished through the use of modification exits in either Phase 1 or Phase 3.

Conversion of data records from fixed-length to variable-length format, or from variable-length to fixed-length format, can be accomplished through the use of modification exits in either Phase 1 or Phase 3. Performing of either of these conversions requires the subroutines for processing variable-length records; the user must have specified the VARIA parameter (see "Program Definition") on the Sort Definition control card.

If the input file is on disk, and the output file is to be placed on disk, the disk file form (A, G, or C) designated for input will also be used for output; the user must not, through any modification routine, alter the designation. The disk record sizes, however, need not be the same for input and output.

### **Magnetic Tape Output**

The user may specify, through a Sort Definition control card, that the program write the output file on magnetic tape. The sort program will write the records in the Move mode. This procedure, consistent with input operations, makes possible the sorting of a data file that was written in the Load mode, and the creation of a sequenced output file that can be processed in the Load mode by a subsequent operation. (Form 4 records written in the Load mode, however, are not acceptable to the sort.) Moreover, this procedure avoids the inefficiencies that would result from reading and writing data in the Load mode during the entire sorting process. The sort can be modified by the user to produce unblocked, variable-length records in the Load mode, if that output is desired.

### **Disk Output**

The user may specify, through a Sort Definition control card, that the program write the output file on disk. Either the Full Track without Addresses or Single Record output method may be used. In both cases, data will be written in the Move mode.

The first method uses the Write Full Track without Record Addresses instruction and is carried out by the iocs routines for Form A (Sequential-Full Track) disk files (see *Basic Input/Output Control System*). Since records will be blocked according to the output blocking factor specified in the sort program control cards, any desired Move-mode format for writing is acceptable, provided the format is consistent with the specified data record length and output blocking factor.

The second method uses the Write Single Record instruction and can be carried out by either the iocs routines for Form C (Sequential-Geometric) disk files, or the iocs routines for Form G (Partitioned Sequential-Geometric) disk files (see *Basic Input/Output Control System*). The output written using this method can consist of blocked data records, provided the format for the output disk records is consistent with the data record length and output blocking factor specified in the sort program control cards.

**Disk Output End-of-File:** If the output file is written on disk, a count of the number of blocks in the file will be placed in the Resident Monitor /IPI/ field. This information is thus available for the subsequent program within the job.

### **Disk Work Space and Format Requirements**

When the sort program is defined, the user specifies the disk space to be used by the sort for work areas during Phase 2. This is done through the designation of symbolic units. Physical units must be assigned, via System Monitor ASGN cards, to each symbolic unit

before execution of the sort program. The actual boundaries of the physical disk areas are established during system generation.

Disk work space must be formatted to provide a 2,800-character record in the Move mode on each track. The total amount of disk space (all the disk areas) assigned to each work area must be composed of consecutive tracks and contained within one module.

**NOTE:** A full module (10,000 tracks) must never be defined as a work area. No more than 9,999 tracks should be defined as the disk sort work area.

The sort program will read data from and write data on these tracks using the iocs routines for Form G (Partitioned Sequential-Geometric) disk files (see *Basic Input/Output Control System*). If 2302 Disk Storage is used, the work area will consist of 2,800-character sectors of each track, with each sector in the same relative position on each track.

As mentioned under "Sort Capacity," the number of disk tracks required for a given sorting application is dependent on three variables: core storage size, file size, and data record length. The number of cylinders required can be estimated by referring to the sort timing tables or using the formulas in the Appendix.

### **Control Data**

The control data word upon which the sort is based may be as long as 2,799 characters (the maximum data record length minus one) and may consist of as many as ten control data fields. Maximum length of any single control data field is 999 characters. The control data fields may be contiguous or they may be scattered throughout the record; however, they must not overlap.

### **Padding**

When fixed-length records are blocked and the number of data records in a file is not evenly divisible by the blocking factor, padding records are necessary. These padding records must meet the normal requirements for blocked, fixed-length data records; that is, they must all be the same length and they must end with a record mark. Since padding is never used with variable-length records, the program automatically eliminates all padding checks whenever the output is to be in this form.

Except for the final record marks, padding records consist entirely of blanks or entirely of nines. When checking for padding, the program will not treat a record as padding if it contains other characters, even though its control data fields consist entirely of blanks or entirely of nines. In connection with this, the user should be aware of two factors. The first is that if his input has been recorded in the Load mode, the sort program will read word separator characters in pad-

ding records into core storage as word separator characters; this is because the sort reads records in the Move mode. Thus, if word separator characters are present in a record, the sort will not consider this a padding record. The second factor is that if there are data records in the file with all blanks (or all nines) in the control data fields sorted on, some low (or high) padding records may possibly get intermixed with the data records. This stems from the fact that in the sorting and merging processes, a padding record may be placed ahead of a data record with the same control data field value. A low padding check ends upon recognition of the first non-padding record; thus, if there is a low padding record among the data records, the check will not reach it. High padding records might not be reached by a high padding check if the user's file contains more than one full block, and user action to initiate the check earlier (see Option E, below) is not taken.

For an ascending sort program, a low padding record is one consisting entirely of blank characters (except terminal record mark), and a high padding record is one consisting of all nines (except for terminal record mark). For a descending sort, the nines records are low padding and the blanks records high padding.

A block containing low padding will always appear as the first block in the output file, with the low padding records appearing as the first records in the block. Similarly, a block containing high padding will always appear as the last block of the output file, with the high padding records appearing as the last records of the block.

The sort program will handle padding records in accordance with the padding option specified on the OUTPUTFILE control card (see "Program Operation"). The options are differentiated by such factors as whether high or low padding will be added, whether or not the program will check for padding already present (high and/or low), and whether or not the program will eliminate padding already present (high and/or low).

In all the padding options, the same general padding principle exists: if the total number of output data records is not evenly divisible by the output blocking factor, the number of padding records required to complete the block will be placed in the block. This operation takes place in Phase 3.

If the user specifies that the program should check for high padding records already present, a calculation is made in Phase 3 to determine the number of data records that can be processed before it is necessary to start the check. This calculation is based on the assumption that:

1. If the input file is on one disk area or one reel of tape, less than one full block of high padding records is present.

2. If the input file is on more than one tape reel or disk area, less than one full block of high padding records per reel or disk area is present.

If an input file contains more high padding records than the number permitted by the above-mentioned specifications, an adjustment of the calculation routine should be made via a user-written modification routine at exit P34 (see Option E, below); this is to insure that the output file will not contain full blocks of high padding records.

The various padding options available and the letters used to specify them are:

PADDING OPTION LETTER	DESCRIPTION OF OPTION
A	The program will not check for padding records. Added padding, if required, will be high padding.
B	The program will check for high padding only. High padding records in excess of the completed block will be dropped from the output file. Added padding, if required, will be high padding.
C	The program will check for low padding only. Full blocks of low padding will be dropped from the output file. Added padding, if required, will be low padding. However, if records are added or deleted during Phase 3, the program may be required to add high padding to the last output block.
D	The program will check for both high and low padding, and eliminate all low padding. High padding records in excess of the completed block will be dropped from the output file. Added padding, if required, will be high padding.
E	The program will check for both high and low padding. Full blocks of both high or low padding will be dropped. Added padding, if required, will be low padding. If high padding records are present in the input file, and the number is known to the user, he can effect the dropping of all high padding records. This is done by including a modification routine at exit P34; the user should place at linkage symbol DH62/ the number of high padding records that have entered the sort. However, if records are added or deleted during phase 3, the program may be required to add high padding to the last output block.  If the user wishes the sort program to start the high padding check earlier in Phase 3, he should place at linkage symbol DH62/ the number of records over the normal amount that should be checked.

### Tape-Label Options

The sort program(s) created can process IBM 1410 80-character tape labels or IBM Standard 120-character

labels; this is done through iocs routines contained in the Resident Monitor. The sort program itself provides none of the label-handling routines. However, if tape labels are to be processed, the necessary information must be provided through the sort program control cards.

Nonstandard labels may be processed through the use of modification exits provided in the File Table Extension (see "Program Modification"). Format specifications for standard tape labels and the recommended tape labeling practices are described in the publication *Basic Input/Output Control System*. The sort program will also handle tapes that contain no labels.

Each of the tape-label options that can be specified applies for all tapes used by the sort program. For example, if IBM 1410 80-character tape labels are specified, all input and output tapes must contain labels of this type. If some of the tapes contain 80-character labels, and others contain 120-character labels, or some tapes do not have labels, then the labels must be treated as nonstandard; this involves label-handling through user-written modifications to the sort program. Exit points may also be used for additional tape-label routines that the user may wish to include. The type of tape label processed in each option, and the code for the option, are shown in Figure 4; if tape labels are to be processed, the user specifies the desired option number in the TYPELABEL parameter on the LABELDES sort program control card.

Option	Code
80-character 1410 labels	1
120-character IBM Standard labels	2
Nonstandard labels	3

Figure 4. Tape-Label Options

Designation of the tape-label fields to be used in processing input/output tape labels are made via parameters in the LABELDES control card. This information is subsequently entered into the pertinent File Table Extension. If IBM 1410 80-character or IBM Standard 120-character tape labels are being processed, the user may designate through other LABELDES parameters the tape-label fields he wishes checked on input and/or output. If nonstandard labels are employed, the LABELDES card may be used to specify information for tape labels; however, label checking must be done through user modifications to the sort program.

## Input/Output Error Correction Options

The Resident iocs will make repeated attempts to read an input block before deeming the block uncorrectable. For those records that are uncorrectable, however, two sets of iocs routines are provided. The "Accept" routines will process the uncorrectable input records as if they were error-free (i.e., release them to the sort program as the iocs would release an input record read without error indication). The "Skip" routines will read the next input record into the same area that contained the uncorrectable record, thereby bypassing the erroneous record. The user, through the SORTTYPE sort program control card, determines which of these procedures will be followed. However, if the "Skip" option is selected, uncorrectable records will be bypassed only during Phase 1 input operations.

The standard tape or disk error correction routines included in the Resident iocs are used by the sort program. Further error correction routines, if desired, may be included at iocs exit points (see *Basic Input/Output Control System*). By modifying fields in Sort Common, the user can specify that: (1) the iocs, upon detecting a particular type of error, exits immediately to the user's error correction routine; or (2) the iocs, upon detecting the error, exits to the user's routine only if standard procedures fail to correct the error.

## Checkpoint and Restart

The Resident iocs provides the routine for writing checkpoint records; the user may designate on the SORTTYPE control card that checkpoint records be written for the sort program. The publication *Basic Input/Output Control System*, describes the operation of the routine.

If the CHKPOINT-Y parameter is included, checkpoints will be taken during execution of the program at the following points:

1. At the start of Phase 1 prior to the opening of the input file.
2. At the start of Phase 3 prior to the opening of the work files (which provide input to the final merging pass).

The program can be restarted from either checkpoint through the use of the System Monitor restart routine. The details for restarting from a checkpoint can be found in the publication *IBM 1410/7010 Operating System; Operator's Guide*, Form C28-0351. If the sort program operates in an environment that includes a Tele-processing system, the checkpoint facility cannot be used.

The Generalized Disk Sorting Program provides the user with the capability of creating different sorting programs to meet his requirements. Selection of the appropriate sort subroutines for the desired program(s) is performed by the Sort Definition Program. By including parameters or excluding sets of parameter alternatives on a Sort Definition control card, the user provides the information necessary for the Sort Definition Program to carry out its function.

After analyzing the parameters, the Sort Definition Program produces a set of card-image records specifying which of the relocatable sort subroutines should be included in the sort program desired. These records are written out on symbolic unit MW2, which must be assigned as a magnetic tape unit by the user. By means of the INPUT control card, the user directs the Linkage Loader to take its input from this unit. The Linkage Loader converts the selected sort subroutines from relocatable to absolute format.

The sort program(s) can be produced with user-written modification routines included. These routines can be inserted at various locations (exit points) in the program. The routines, which must be in relocatable format, can reside on the srw, the Go file, or the System Library file. If the srw contains the routines, the cards must follow the Sort Definition control cards for that program. If the routines reside in the Go file, or in the Sort Subroutine Library of the System Library file, the appropriate CALLN cards must be placed in the srw. Procedures for inclusion of user-written modification routines are detailed in the "Program Modification" section.

### Control Information

The Sort Definition Program needs two kinds of information: (1) specifications regarding the nature of the program desired, and (2) specifications of the symbolic units to be used. The user communicates this information to the Sort Definition Program by means of two control cards: the Sort Definition card and the Unit Definition card. Functions of these cards and the parameters that may be included on each are explained in the following subsections.

The Sort Definition Program processes a Sort Definition card and a Unit Definition card as a pair. A number of these pairs may be used during one execution of the Sort Definition Program to produce as many

sort programs as there are pairs of cards; however, if a pair does not contain one card of each type, the program intended will not be defined. Either the Sort Definition or the Unit Definition card may appear first in the srw. When one card of each type is found, the Sort Definition Program proceeds with the definition of the desired sort program.

### Sort Definition Card

The purpose of the Sort Definition card is to enable the user to specify the parameters for the desired sort program. The user also establishes a name for his sort program through this card.

#### Format of the Sort Definition Card

*Card Columns 1-5:* These columns are unused.

*Card Columns 6-15:* Program Identification — The user places in this field the name by which the produced sort program will be identified. The name can be one to ten alphameric characters in length, left-justified in the field. The first character must be alphabetic. No special characters may be included anywhere in the name.

This name will be used in the System Monitor EXEQ card that effects the loading and execution of the sort program. If the produced sort program is to be included as a phase of a larger program, the Program Identification field can be left blank.

*Card Columns 16-20:* Card Identification — The user places in this field the letters DSORT; this is the mnemonic by which the Sort Definition card is identified.

*Card Columns 21-72:* Parameter List — The Sort Definition Program will use the information in this field to define the sort program. The user may leave this field blank, or designate from one to six parameters (see below). If the user desires to increase the mnemonic value of any parameter, he can expand the parameter to a maximum of ten characters; each parameter can also be reduced to its first three characters.

The parameters must be separated by commas and may appear in any order. If one or more parameters are designated, no blanks are permitted in the area from column 21 to the last column occupied by a parameter character. Parameter analysis terminates when the Sort Definition Program recognizes the first blank character; further information on the card will be ignored.



With the exception of PCH (see below), each parameter that the user may specify can be one of two choices; absence on the control card of both choices results in the selection of the first of the alternatives. Therefore, if the first parameter alternative is desired, the user need make no entry for that pair on the control card.

*Card Columns 73-80:* These columns are unused.

#### Sort Definition Card Parameters

The Sort Definition parameters are placed in the Parameter-List field, columns 21-72. The parameters that may be specified, their meanings, and, if alternatives are involved, the results of excluding both choices are as follows:

##### INTAPE

Input to the created sort program will be from magnetic tape or the SIU. (If the input will be from the SIU, the user must specify SIU in the INPBLKNG parameter on the INPUTFILE sort program control card — see "Program Operation.") If neither INTAPE nor INDISK is specified, INTAPE will be assumed.

##### INDISK

Input to the created sort program will be from 1301 or 2302 Disk Storage, or from the SIU (see above).

##### OTTAPE

Output from the created sort program will be written on magnetic tape. If neither OTTAPE nor OTDISK is specified, OTTAPE will be assumed.

##### OTDISK

Output from the created sort program will be written on 1301 or 2302 Disk Storage.

##### FIXED

The created sort program will process fixed-length data records. If neither FIXED nor VARIA is specified, FIXED will be assumed. SIU input can be used only with a program that processes fixed-length data records.

##### VARIA

The created sort program will process variable-length records.

##### MULTI

The created sort program will process records that contain a control data word consisting of one or more control data fields. If neither MULTI nor ONE is specified, MULTI will be assumed. Sort programs created can process single-control data fields if MULTI is specified, but with less efficiency than if ONE were specified.

##### ONE

The created sort program will process records that contain only one control data field. This parameter will cause the Sort Definition Program to omit from the sort program the instructions and subroutines necessary to handle multiple-control data fields.

##### UNMOD

The created sort program will contain only the sort subroutines selected, and no user-written routines. This parameter instructs the Sort Definition Program not to look for added programming. If neither UNMOD nor MOD is specified, UNMOD will be assumed.

##### MOD

The created sort program will contain the user's routines in addition to the sort subroutines selected. This parameter instructs the Sort Definition Program to look for and include added programming supplied by the user. The

nature of added programming and how it can be incorporated into sort programs through the Sort Definition Program are discussed in "Program Modification."

When the MOD parameter is specified and the input records are of fixed length (i.e., the FIXED parameter is specified, or both FIXED and VARIA are omitted), Phase 1 of the sort program will be defined as using an input area; this will allow the input records to be referenced during Phase 1 by the user's added programming. If the MOD parameter is desired, but the user's added programming makes no reference to the data records during Phase 1 (i.e., Exit P11 is not activated), the user may, when specifying the MOD parameter, prefix it by a Q (QMOD). This will cause the Sort Definition Program to define a Phase 1 that will read the input file directly into the Record Storage Area. This will avoid the additional movement of each record required when an input area is used.

If the user's input to the sort resides on the SIU, he must specify the MOD parameter on the Sort Definition card. SIU input requires the input area created in Phase 1 as a result of the user's specifying this parameter.

##### PCH

If this parameter is included on the Sort Definition control card, the Sort Definition Program will place its output on the Standard Punch Unit (SPU) as well as on the normal output unit, MW2. This punched output can be used as input to the Linkage Loader from the SIU to produce the same sort program during subsequent runs.

Example: In order to: (1) define an unmodified sort program that will take its input from magnetic tape, process variable-length records with multiple control fields, and place the output on disk; (2) give the resultant program the name SORTTEST; and (3) have the output from the Sort Definition Program punched out, as well as written on mw2, the following Sort Definition card could be used:

Col	6	13	16	21	43
	SORTTEST		DSORT	VARIABLE,MUL,OTDISK,PCH	

##### NOTES:

1. The Sort Definition Program will assume UNMOD had been indicated, since neither it nor the parameter MOD (or QMOD) appears. The Sort Definition Program will therefore not look for added programming.
2. The Sort Definition Program will assume INTAPE had been indicated, since neither it nor the parameter INDISK appears. Input to the sort program produced will therefore be from magnetic tape.
3. The parameter VARIA has been expanded to increase its mnemonic value.
4. The parameter MULTI has been condensed to the first three characters.

#### Unit Definition Card

The Unit Definition card specifies the symbolic input, output and work units that will be used by the sort program produced. The user must be sure that prior to execution of the sort, physical units are assigned to the symbolic unit via the System Monitor ASGN cards.



### Format of the Unit Definition Card

*Card Columns 1-5:* These columns are unused.

*Card Columns 6-15:* This field must be left blank.

*Card Columns 16-20:* Card Identification — The user places in this field the letters DUNIT; this is the mnemonic by which the Unit Definition card is identified.

*Card Columns 21-35:* Parameter List — This field specifies the symbolic input, output, and work units for the sort program to be produced. Each symbolic unit designated constitutes a parameter. The user must designate exactly four parameters regardless of the type of sort program he is creating.

The symbolic units are designated by system symbols written without preceding and final slashes (e.g., MW1 instead of /MW1/); listing of the symbolic units begins in column 21. The designations must be separated by commas. No blanks are permitted in this field. Parameter analysis terminates when the Sort Definition Program recognizes the first blank character in the Parameter List field or remaining card columns; further information on the card will be ignored. The order in which the symbolic units are placed in the Unit Definition card is of prime significance.

*Card Column 36:* This column should be blank.

*Card Columns 37-80:* These columns are unused.

### Unit Definition Card Parameters

The parameters that may be specified in the Parameter-List field (columns 21-35) of the Unit Definition card are symbolic units; the function of each specified symbolic unit will depend on its relative position within the Parameter-List field.

The first parameter designates the symbolic unit to which the user will assign the physical unit(s) containing the sort input file. (Considerations for the assignment of physical units are discussed below.) If the input file resides on the sru, a symbolic unit must be designated here; in this case, physical units need not be assigned to this symbolic unit.

The second parameter designates the symbolic unit to which the user will assign the physical unit(s) for the sort output file. This symbolic unit may be the same as the one designated for input.

The third parameter designates the symbolic unit to which the user will assign the physical unit(s) constituting the first disk work area, known as work area A.

The fourth parameter designates the symbolic unit to which the user will assign the physical unit(s) constituting the second disk work area, known as work area B.

*Relation of the Parameters to Program Operation:* Initial input to Phase 1 of the created sort program is

from the symbolic unit specified as the first parameter. Phase 1 output is distributed on both disk work area A (third parameter) and disk work area B (fourth parameter). During Phase 2, the program uses the two work areas for merging. Records are read from one area and merged onto the other; then records are read from the second area and merged onto the first. This alternate use of each of the work areas for merging continues until the number of sequences is equal to or less than the merge order for Phase 3. In Phase 3, the final sort output is written on the symbolic unit specified as the second parameter.

The program always designates as work area A the area with the greater number of assigned tracks. The sort will interchange the third and fourth parameters at sort program object time if the fourth symbolic unit (designating work area B) comprises more disk space than the symbolic unit designated as the third parameter.

*Example of the Unit Definition Card:* To read input to a sort from MR1, use MR2 and MR3 as work areas, and have the output written on MR4, the following Unit Definition card would be used:

Col	6	16	21	35
	(blank)	DUNIT	MR1,MR4,MR2,MR3	

### Assignment Considerations

The physical unit(s) assigned, via a System Monitor ASGN card, to the symbolic unit for input (first Unit Definition card parameter) may be either a tape unit(s) or disk area(s). The physical unit(s) assigned to the symbolic unit for output (second Unit Definition card parameter) may also be either a tape unit(s) or disk area(s). For each symbolic work file unit (third and fourth parameters), the physical units must, of course, be disk areas.

If the symbolic unit for input is disk, and more than one physical unit (disk areas) is assigned, the individual physical areas need not be contiguous to each other; they may be placed anywhere on the disk module. However, if this noncontiguous arrangement is used, each physical area must be filled with records (if the IBLCKCOUNT parameter is used on the INPUTFILE sort program control card, the last physical area need not be filled). If the symbolic unit for output is disk, and more than one physical unit (disk areas) is assigned, the individual areas need not be contiguous to each other. However, the disk space for each work file area must be integral; if more than one physical unit is assigned to a symbolic work file unit, all the tracks within the total work area must be consecutive. For 2302 Disk Storage, each 2,800-character record sector in each cylinder must also be provided on the same relative position on each track.

For each work area, the amount of disk work space assigned determines the merge order to be performed by Phase 2 of the created sort program. All the disk space for work area A must be contained entirely within one disk module. Similarly, all the disk space assigned to work area B must be contained entirely within one disk module.

If 1301 Disk Storage is used, and two modules are available for the sort, the A and B work areas should be contained on different modules. If only one 1301 disk module is available for the sort, forcing the user to include both work areas in that module, the program will require more disk seek time and operate with less efficiency than if two modules were available. If 2302 Disk Storage is used, the two work areas should each be serviced by different access arms for optimum efficiency.

If the two modules of 1301 (or 2302) Disk Storage are provided on separate channels, the program will overlap reading and writing operations wherever possible.

A complete discussion of the function and use of symbolic units, and a description of the ASGN cards, can be found in the publication *System Monitor*. For information on the assigning of disk space to physical units, consult the publication *System Generation*.

### Sort Definition Program Operation

The disk Sort Definition Program is included on the Master file as part of the relocatable library. The user decides how he will utilize the program and, consequently, which Operating System file he will use to contain the program; this decision is based on the installation's sort requirements. Complete information on how to generate the Operating System files is contained in the publication *System Generation*.

### Relocation of the Sort Definition Program

The user may relocate the Sort Definition Program during system generation (i.e., while in sg mode) or during system operation (i.e., during the day's processing). In the latter case, the user must first, through system generation runs, include the Sort Definition Program on the System Library file. Before it can be executed, the program must be relocated through the Linkage Loader and placed in absolute form on the Job (MJB) file. This conversion from relocatable to absolute form during the day's processing can be accomplished using the following cards:

```
Col  6          16      21
      PHASE      DSRTDEFINE
      CALL       IBDSRTDEF
```

If the user wishes to include the Sort Definition Program on a System Generation File (SGF) or System Operating File (SOF), he must relocate the program during system generation. This relocation, performed by the Linkage Loader while operations are in the sg mode, can be accomplished using the following card:

```
Col  6          16      21
      CREAT      DSRTDEFINE
```

### Execution of the Sort Definition Program

#### Execution During System Operation

If the Sort Definition Program has been relocated during system generation and placed on the sof, the user can execute the program (producing the desired sort program in absolute format) by using the following cards:

```
Col  6          16      21
      .
      .
      .
MON$$  EXEQ      DSRTDEFINE
      ..(name).. DSORT  ... (parameters) ...
      DUNIT      ... (parameters) ...
      LINKLOAD   (other cards as desired)
MON$$  EXEQ      LINKLOAD
      INPUT      (other cards as desired)
      MW2
      .
      .
      .
```

If the Sort Definition Program has been relocated during system operation and has consequently remained on the Job file after relocation, the above cards, with one alteration, can be used for executing the program. The first operand (DSRTDEFINE) of the first card listed must be followed by a comma and the letters MJB.

#### Execution During System Generation

The user may desire to include the created sort program(s) on the sof; this would involve executing the Sort Definition Program during system generation. If the Sort Definition Program has already been placed, in absolute format, on an SGF or SOF, it may be executed as part of a system generation run; the resultant sof will include the sort program(s) specified.

The location of the sort program(s) on the new sof can be controlled through proper placement of the Sort Definition Program EXEQ and control cards in the system generation control card deck. The Sort Definition EXEQ and control cards must be in the appropriate position relative to the INCLD cards of the preceding and succeeding executions of SG1. The Sort Definition Program uses symbolic unit MW2 for output; this output is used as input to the Linkage Loader.

To exemplify this operation, assume that the following sequence of absolute programs is desired on the new SOF:

```

Program 1
Sort A
Sort B
Program 2
Sort C (with user-written modification routines)
Program 3

```

Assume also that Programs 1, 2, and 3, in addition to the Sort Definition Program, reside on the system generation source file in absolute format. To place the programs on the SOF in the desired sequence, the following cards would be used as part of the SIU control card deck for the system generation run:

```

Col  6          16          21
MON$$  EXEQ      SG1
      INCLD      PROGRAM1
      END
MON$$  EXEQ      DSRTDEFINE
SORTA  DSORT    ...{parameters}...
      DUNIT    ...{parameters}...
SORTB  DSORT    ...{parameters}...
      DUNIT    ...{parameters}...
MON$$  EXEQ      LINKLOAD
      INPUT     MW2
MON$$  EXEQ      SG1
      INCLD      PROGRAM2
      END
MON$$  EXEQ      DSRTDEFINE
SORTC  DSORT    ...{parameters}...
      DUNIT    ...{parameters}...
      .
      .
      .
      (User modification cards)
      .
      .
      .
MON$$  EXEQ      LINKLOAD
      INPUT     MW2
MON$$  EXEQ      SG1
      INCLD      PROGRAM3
      END

```

## Sort Definition Messages

Messages are issued during execution of the Sort Definition Program to provide information on existing control card errors, or to communicate data for general diagnostic use. This subsection describes the wording of each message, explains the meaning of the message, and indicates the course of action that may or must be taken should the message occur.

Each message produced on the console printer and/or the Standard Print Unit (SPR) by the Sort Definition Program will begin with a five-digit identification code. The code numbers have been designated to increase the information value of the messages. A complete description of the codes is contained under "Sort Program Messages," in the "Program Operation" section.

- 00301 *Console:* 00301- SDP  
*SPR:* 00301- INSUFFICIENT SORT DEFINITION CARDS  
*Explanation:* Either the DSORT or DUNIT card is missing and the Sort Definition Program cannot complete its execution. If no valid sorts have been defined, indication will be given to the System Monitor that any subsequent dependent program(s) should not be executed and the Monitor should skip to the next job, if possible. If one or more valid sorts have been defined, the program searches for the next Monitor control card. The 00399 message will also be written on the SPR.  
*Action:* No operator action is possible. The user must provide the missing control card and re-execute the program.
- 00399 *Console:* None  
*SPR:* 00399- END SORT DEFINITION PROGRAM  
*Explanation:* For general diagnostic use. The System Monitor has notified the Sort Definition Program that end-of-file has been reached on the SIU, and the Sort Definition Program has completed its execution.  
*Action:* No operator action required. The program will return control to the Monitor for execution of the next program.
- 10301 *Console:* None  
*SPR:* 10301- ERROR IN DSORT OR DUNIT IDENT.  
 —(invalid card)—  
*Explanation:* The Sort Definition Program has read a card that should be either a DSORT or DUNIT card, but does not contain either identification in columns 16 through 20. The entire contents of the card in error are printed. Execution continues. The program searches for the complementing card type until either the required card type is found or a Monitor card is reached. Intervening cards not of the required type are considered erroneous, and their contents are printed out on the SPR.  
*Action:* None
- 10302 *Console:* None  
*SPR:* 10302- INVALID PARAMETER IN DSORT CARD—(invalid card)—  
*Explanation:* One of the parameters specified on the DSORT card is not a valid parameter. The entire contents of the card containing the invalid parameter are printed on the SPR. Execution continues. The Sort Definition Program defines the program using the valid parameters, issues a 20304 message, and enters a waiting loop.  
*Action:* None
- 10303 *Console:* None  
*SPR:* 10303- INSUFFICIENT UNITS DEFINED IN DUNIT CARD—(invalid card)—  
*Explanation:* Less than four symbolic units for the sort have been designated on the DUNIT card. The card is rejected and the entire contents are printed. Execution continues. The Sort Definition Program searches for the next pair of valid definition cards. Any previous DSORT and DUNIT information will be overlaid by information in the valid pair.  
*Action:* None
- 10304 *Console:* None  
*SPR:* 10304- UUUUUUUUUU IS DEFINED AS VVVVVVVV, WWWWWWWW, XXXXX, YYYYY, ZZZZZZZZ  
*Explanation:* For general diagnostic use. The Sort Definition Program has completed the definition of a sort program described in the message. The codes listed above will be replaced in the actual message as follows:

UUUUUUUUUU will be the name assigned on the  
 DSORT card by the user  
 VVVVVVVV will be TAPE IN or DISK IN  
 WWWWWWWW will be TAPE OUT or DISK OUT  
 XXXXXX will be FIXED or VARIA  
 YYYYYY will be UNMOD or MODIF  
 ZZZZZZZZ will be MULTI CF or ONE CF  
 Execution of the Sort Definition Program will continue.  
 Action: None required

10305 Console: None  
 SPR: 10305- NO NAME GIVEN FOR THIS SORT  
 Explanation: No name was assigned to the program being produced. Thus, the user will be able to execute the sort program only as a phase of a larger program. Execution of the Sort Definition Program continues. The program will complete definition of the current sort program, issue a 20304 message, and enter a waiting loop.  
 Action: None

20304 Console: 20304- UUUUUUUUUU is VVVVVVVV,  
 WWWWWWWW, XXXXXX, YYYYY, ZZZZZZZZ  
 SPR: 20304- UUUUUUUUUU IS DEFINED AS  
 VVVVVVVV, WWWWWWWW, XXXXXX, YYYYY,  
 ZZZZZZZZ  
 Explanation: In defining the sort program described in the above messages, the Sort Definition Program detected one or more potential control card errors. The definition process for this sort program was completed,

but there is a possibility that undesired results were obtained.

The codes listed above will be replaced in the actual message as follows:

UUUUUUUUUU will be the name assigned on the  
 DSORT card by the user  
 VVVVVVVV will be TAPE IN or DISK IN  
 XXXXXX will be FIXED or VARIA  
 YYYYYY will be UNMOD or MODIF  
 ZZZZZZZZ will be MULTI CF or ONE CF

After writing the message, the Sort Definition Program will enter a waiting loop.

Action: Press INQUIRY REQUEST. If the program defined is acceptable, and continued execution of the Sort Definition Program (if other programs are to be defined) or succeeding programs is desired, type the three characters \$31 and press INQUIRY RELEASE. If the program defined is not acceptable and should be eliminated, type the three characters \$32 and press INQUIRY RELEASE. In the latter case, the program will proceed as it would with an uncorrectable error; subsequent output on MW2 will overlay the output from the previous execution of Sort Definition Program, thus destroying the erroneous definition statements generated. During the waiting loop, and before typing \$32, the user may perform the action necessary to replace the erroneous cards in the SIU.

If either set of digits is typed by the operator, the 00399 message will be written on the SPR. Typing of any digits other than \$31 or \$32 will not break the waiting loop.

After the Sort Definition Program completes its execution, and the created sort program(s) resides in absolute format on either the `SOF` or `MJB`, step two in the overall process of producing an executable sort program can begin (see "Introduction"). In this step, the sort program, acting on control-card information supplied by the user, alters itself to meet the requirements of the user's specific application.

The step occurs at object time and thus immediately precedes the actual processing of the user's file (the sort input file). The control cards used for this step are known as the sort program control cards; they are placed in the `SVU` after the System Monitor `EXEQ` card for the sort program to be run. The `ASGN` cards (see "Assignment Considerations" in the "Program Definition" section) for the program, or for the job in which the program will be executed, must be located in the `SVU` before the sort program `EXEQ` card.

When the `EXEQ` card is read, operation of the sort program begins. The sort program control cards provide information necessary to the sort program for the processing of the input file. Contained in these cards are entries that describe the logical records, the input and output files, and the control fields on which the records are to be sorted. The cards may also contain entries that specify options desired, provide information for tape-label processing, and/or supply data on any user-written modification routines included in the program.

### Preparation of Control Cards

The user decides which entries, or parameters, he should include on the sort program control cards; this is based on the requirements of his particular application. Certain parameters must be included regardless of the type of application; others must be included if the input file is of a certain type; other parameters are purely optional.

Each control card is subject to an extensive validity check by the sort program; however, the program cannot possibly protect the user against all possible erroneous entries and inconsistent combinations of entries. Therefore, accurate preparation of control cards by the user is of prime importance for the successful execution of the program.

### Format of the Control Cards

The sort program control cards are closely akin in format to other control cards used throughout the Operating System. Format for the sort control cards is as follows:

*Card Columns 1-4:* These columns are not used.

*Card Column 5:* End Card Indicator — The letter "E" is required in this column if the card is the *last* sort program control card, and any card other than a System Monitor control card immediately follows. This will prevent the sort program's general assignment routine from reading beyond the control cards for that sort program.

*Card Columns 6-15:* Card Type—The user places the card-type name in this field. The entry must be left-justified with any unused positions in the field left blank. There are five different types of sort program control cards (see "Control Card Types").

*Card Columns 16-20:* Control Card Identifier — The characters `SORT` are punched in columns 16-19, with column 20 blank (i.e., `SORTb`); this indicates that the card is a sort program control card.

*Card Columns 21-71:* Parameter List—The user places the sort program parameters in this field, using the general format:

ABC-kk, DEF-mmm, GHI-p . . . XYZ-nnb

where:

ABC, DEF, GHI, and XYZ are the parameter labels naming the parameters. The first three characters of each parameter label are constant; the user may add any succeeding letters he desires. Purpose of the expansion facility for the parameter labels is to allow for increased mnemonic value, if desired; the user may also reduce any expanded parameter label to its first three characters. The characters `kk`, `mmm`, `p`, and `nn` stand for parameter values that must be assigned by the user. The parameter value can be either alphabetic or numerical, depending on the particular parameter used. The number of parameter value positions also varies for each parameter.

The character `b` is a blank character following the last parameter on the card. Information between this blank character and column 72 will be ignored.

*Card Column 72:* This column is always blank.

*Card Columns 73-80:* User's Identification—This field may be used to identify the particular sort run. The General Assignment Phase of the sort program will check the identification of all the sort program control cards; if the identification is not the same for all the cards, an information message (code 10306) will be given on the `SPR`. The contents of User's Identification field will be shown in a program identification message (10301) given on the `SPR`.

## Specifications for the Control Cards

1. The hyphen (minus) character (—) is used to separate the parameter-label and the parameter-value fields, and must not appear in other locations on the control cards.

2. The comma (,) character is used to separate parameters and must not appear in other locations on the control cards.

3. Blank characters may appear anywhere in the parameter-label field except in the first three positions. Blank characters must not, however, appear within the parameter-value field. The last parameter on each card must be followed by a blank character.

NOTE: Restrictions regarding commas, hyphens, and blank characters, as indicated in the above specifications, do not apply to the placement of these characters in the parameter-value fields of the IFILEIDENT and OFILEIDENT parameters. (See "LABELDES Parameters" under "Control Card Types.")

4. Group marks must not appear in any position on the control cards.

5. The length of a parameter-value field must not exceed the allowable number of characters for the field.

6. A parameter label and its value (ABC-*nn*) must be contained in one card.

7. Parameters may appear in any order on the control cards, and the cards themselves may be in any order. All the parameters within one card, however, must be those that can be used with the control-card type specified in columns 6-15. Two parameters with the same parameter label (i.e., with the same first three characters of the parameter label) must never be used in the same card, or in different cards of the same control-card type.

8. Any number of cards of each control-card type may be used.

9. Leading zeros in numeric parameter-value fields may be omitted except on LABELDES cards.

## Control-Card Types

The five different types of sort program control cards are: SORTTYPE, INPUTFILE, OUTPUTFILE, CNTLFLDS, and LABELDES cards. The number of parameters that may appear on each card is limited only by the space available on the card. The user may include as many cards of each type as he desires. The cards may appear in any order.

General functions of each of the five control-card types are as follows:

CARD TYPE	FUNCTION
SORTTYPE	Provides the sort program with general information on the file to be sorted and the manner in which the file will be processed.
INPUTFILE	Provides the sort program with information pertaining to the input file.

CARD TYPE	FUNCTION
OUTPUTFILE	Provides the sort program with information pertaining to the output file.
CNTLFLDS	Defines the control data fields that the sort program will use to place the records in order.
LABELDES	Provides the sort program with information on the tape-label requirements of the tape input and/or tape output files. If disk is used for input and output, or if the tapes used contain no labels, this card type is <i>not</i> required.

The following paragraphs describe the parameters that can be used for each control-card type. In each case, the parameter itself (parameter label, hyphen, and parameter value) is given, followed by an indication as to whether the parameter is required, optional, or required only for or under certain conditions. An explanation of the structure and use of the parameter completes each description.

The parameter labels shown can be expanded, or reduced to the first three characters. For the parameter field, an "n" is used in the parameter descriptions to represent each position of the field. When the user prepares the control cards, he must include for each specified parameter the first three characters (and added characters, if desired) of the parameter label, the hyphen, and the appropriate parameter value.

## SORTTYPE Parameters

RECLEN-*nnnn*

(Required)

The parameter-value field is numerical, with a maximum length of four characters; it contains the data record length for fixed-length records, or the maximum data record length for variable-length records, including, in both cases, the terminal record marks. The data record length specified must reflect the presence of a record mark if the record mark is present on input or will be added on output (see "Features and Specifications"); if the record mark present on input is deleted on output, the parameter-value field must still reflect the length of the record with the record mark. If the record length is changed by user-written modification routines, the user must specify in the parameter-value field the length of the data record as processed by the program. Since the sorting operation requires a record mark at the end of each data record, one situation will necessitate the temporary addition of these record marks. If the user has specified unblocked input without record marks, and unblocked output without record marks, the sort must add record marks in Phase 1 and delete them in Phase 3. In this case, the user specifies in the RECLEN parameter, the length of the record without the record mark; the sort program itself will auto-

matically increment the value in the data record length field by one. The maximum and minimum values possible for data record length are specified under "Input and Output Specifications" in the "Features and Specifications" section.

DESCEND-n

(Optional)

This parameter is used for specifying that the sort arrange the output file in descending collating sequence. The parameter may also be used to specify an ascending sort; however, omission of the parameter will result in the records being sorted in ascending order. The single-character parameter-value field is alphabetic, and the following values can be used:

PARAMETER VALUE	MEANING
D	Descending sort
A	Ascending sort

CHKPOINT-n

(Optional)

This parameter is used for specifying that the sort should activate its linkages to the IOCS checkpoint routine. The parameter may also be used to specify that checkpoints should not be taken; however, omission of the parameter will result in checkpoints not being taken. The single-character parameter-value field is alphabetic, and the following values can be used:

PARAMETER VALUE	MEANING
Y	Checkpoints should be taken
N	Checkpoints should not be taken

ERROPTION-n

(Optional)

This parameter allows the user to communicate to the IOCS, through the sort program, that all uncorrectable records should be skipped. The parameter may also be used to specify that uncorrectable records should be processed as if they were error-free; however, omission of the parameter will result in the latter case ("A" parameter value) being assumed. The single-character parameter-value field is alphabetic, and the following values can be used:

PARAMETER VALUE	MEANING
A	This parameter value will cause the IOCS to process all records containing uncorrectable errors as though the records were error-free (i.e., release them to the sort program as the IOCS would release an error-free record into core storage).
S	This parameter value will cause the IOCS to read the next record into the same input area that would have contained the record with the uncorrectable error; the erroneous record is thus bypassed. This option is valid only for Phase 1 input; the File Table area in Sort Common should not be altered to provide this option in Phases 2 or 3.

WRITDSKCHK-n

(Optional)

This parameter is used for specifying that the Write Disk Check feature, for checking all data written on disk, should be utilized. The parameter also may be used to specify that the feature should not be included; however, omission of the parameter will result in the feature's not being included. The single-character parameter-value field is alphabetic, and the following values can be used:

PARAMETER VALUE	MEANING
Y	The Write Disk Check option is to be used.
N	The Write Disk Check option is not to be used.

1SIZMOD-nnnnn

(Optional)

The parameter-value field is numerical with a maximum length of five characters. This parameter is used to specify the total number of positions of core storage that will be reserved for added programming during execution of Phase 1 of the sort program; the actual number should be punched in the parameter-value field. This parameter should be used only if added programming is present during Phase 1.

2SIZMOD-nnnnn

(Optional)

The parameter-value field is numerical, with a maximum length of five characters. This parameter is used to specify the total number of positions of core storage that will be reserved for added programming during execution of Phase 2 of the sort program; the actual number should be punched in the parameter-value field. This parameter should be used only if added programming is present during Phase 2.

3SIZMOD-nnnnn

(Optional)

The parameter-value field is numerical, with a maximum length of five characters. This parameter is used to specify the total amount of core storage that will be reserved for added programming during execution of Phase 3 of the sort program; the actual number should be punched in the parameter-value field. This parameter should be used only if added programming is present during Phase 3.

#### INPUTFILE Parameters

RECFORM-n

(Required)

This parameter specifies the record format of the input file. The single-character parameter-value field is numerical. The values (which correspond to IOCS record form definitions), and the nature of the record formats they represent are as follows:

PARAMETER VALUE	MEANING
1	The user's input file contains unblocked, fixed- or variable-length records that may or may not terminate in a record mark (Form 1 records).
2	The user's input file contains blocked, fixed-length records. Each record must terminate in a record mark (Form 2 records).
4	The user's input file contains blocked, variable-length records with a terminal record mark and a Record Character-Count (Form 4 records). In addition, the first four positions of each block of Form 4 records contain a Block Character-Count.

Form 3 records may be sorted by defining them to the program as Form 1 or Form 4 records (see Figure 3).

#### DISKRDMode-n (Optional)

This parameter is used for specifying the IOCS routines that should be utilized for reading the disk input file and/or writing the output file on disk. If disk input and output have been specified, the routines used will be for the same disk file form. The single-character parameter-value field is numerical, and the following values may be used:

PARAMETER VALUE	MEANING
1	IOCS routines for Form A (Sequential-Full Track) disk files will be used.
2	IOCS routines for Form G (Partitioned Sequential-Geometric) disk files will be used.
3	IOCS routines for Form C (Sequential-Geometric) disk files will be used.

These forms are fully described in the publication *Basic Input/Output Control System*.

If this parameter is omitted, the sort program will assume option 1 (IOCS routines for Form A disk files) had been designated. The information will only be referenced by the program when disk is used for input, output, or both.

#### INPBLKNG-nnnn

(Required only for Form 1 records, Form 2 records, or SIU input)

This parameter is used if the input file contains blocked fixed-length records, or unblocked fixed or variable-length records. The latter case includes SIU input, which must consist of 80-character records with no terminal record mark. In the first case, the parameter is used to specify the input blocking factor. In the second case, the parameter is used to indicate one of three things: (1) that the input file contains unblocked, fixed or variable-length records with record marks; (2) that the input file contains unblocked, fixed or variable-length records without record marks; or (3) that the input file resides on the SIU. In order for the input file to be read from the SIU, the user

must have: (1) included the physical input file on the SIU; (2) defined, via the Sort Definition control card, a modified sort processing fixed-length records; and (3) designated some symbolic disk or tape unit (physical units do not have to be assigned) as the first on the Unit Definition control card. If SIU is designated in the INPBLKNG sort program control card, the fields in Sort Common corresponding to the LENMODREC, RECFORM, and INPBLKNG parameters will be set to conform to this type record; other values designated for the LENMODREC and RECFORM parameters will be disregarded.

The parameter-value field is numerical, with a maximum length of four characters. The following parameters values can be used:

PARAMETER VALUE	TYPE OF RECORDS
0000	Unblocked, fixed or variable-length records (Form 1), without terminal record marks.
0001	Unblocked, fixed or variable-length records (Form 1), with terminal record marks.
SIU	Unblocked, fixed-length 80-character records (Form 1), without terminal record marks. The records reside on the SIU.
(Number of Data Records per Block)	Blocked, fixed-length records with terminal record marks (Form 2).

This parameter is not used for Form 4 records.

#### BLKLEN-nnnn

(Required only for Form 4 records)

This parameter is used for specifying the maximum block length (including the four-position Block Character-Count) present in an input file containing Form 4 records. The parameter-value field is numerical, with a maximum length of four characters. The maximum input block length possible is described under "Input Specifications" in the "Features and Specifications" section.

This parameter is not used for Form 1 or Form 2 records.

#### CHARCNTSIZ-n

(Required for Form 4 records)

This parameter specifies for Form 4 records the number of characters in the Record Character-Count field. The user places the figure in the numerical, single-character parameter-value field. If the user specifies Form 1 records for input, and Form 4 records for output, he must include this parameter on the INPUTFILE card; the Form 1 records must be variable-length and have Record Character-Counts. When used for Form 1 variable-length records, this parameter must be accompanied by the parameter LOCCHARCNT.



## LOCCHARCNT

(Required for Form 4 records)

This parameter specifies the location on the data records of the low-order position of the Record Character-Count field; the relative position number is based on the beginning of the record. If the input consists of Form 4 records, this parameter is required. The parameter-value field is numerical, with a maximum length of four characters. The user punches the actual figure in the field.

If the user specifies Form 1 records for input, and Form 4 records for output, this parameter must be provided, along with the parameter CHARCNTSIZ. The Form 1 records in this case must be variable-length and have Record Character-Counts.

## IBLOCKCOUNT-nnnnn

(Optional; may be used only if the input file is on disk)

This parameter is used to specify the number of disk records (see "Glossary") in the input file. The parameter-value field is alphanumeric, with a maximum length of five characters. The user punches the actual number of records, or the letters IPI, in the value field. This value is used to determine when the end of the input file has been reached.

The numerical value is used if the number of disk records in the input file is known. If the number has been determined by a preceding program and has been left in the Resident Monitor /IPI/ field, the letters IPI should be placed in the parameter-value field. The program will then obtain the desired information from the Resident Monitor /IPI/ field. Since /IPI/ is only five characters long, the maximum number of disk records that may be specified is 99,999.

If the input file is on disk, and this parameter is not provided, the sort program will process records from the disk until the IOCS recognizes that the end of the disk input area has been reached.

This parameter is not used if the input is from tape.

## LENMODREC-nnnnn

(Required only if the input data-record length is changed via Phase 1 modifications, or if record marks absent on input will be present on output)

This parameter is used if either: (1) the input data-record length is changed through a Phase 1 user-written modification routine; or (2) the input data-record length is changed through the addition, on output, of a record mark.

In the first case, the parameter specifies the changed input data-record length for fixed-length records, or the changed maximum data-record length for variable-length records.

In the second case, the parameter specifies the length of the input data record without the record mark. If the input is unblocked without a record mark, and the output is to be either blocked or unblocked with a record mark, this parameter must be used to specify the length of the input data record before addition of the record mark. For these situations, the input LENMODREC parameter provides the sort program with the length (or maximum length) of the input data record, and the RECLEN parameter gives the length of the data record with the record mark (see "Features and Specifications").

If the data-record length specified is not changed by user-written modification routines in Phase 1 or by the addition of a record mark on output, this parameter is not required. The parameter-value field is numerical, with a maximum length of four characters. The minimum and maximum values possible are described under "Input Specifications" in the "Features and Specifications" section.

## FILESIZE-nnnnnnnn

(Optional)

This parameter is used for specifying the total number of records (including padding records, if any) in the input file. The parameter-value field is numerical, with a maximum length of seven characters. The user punches the actual figure in the value field.

When this parameter is specified, the General Assignment Phase will check to see whether or not this number of records will exceed sort capacity, and Phase 1 will check to see whether or not it has received the total number of records.

## PARITY-n

(Optional; may be used only if the input is on tape)

This parameter is used for specifying that the input file will be read in odd parity. The parameter may also be used to specify that the file be read in even parity; however, omission of the parameter will result in the file's being read in even parity.

The single-character parameter-value field is alphabetic and the following values may be used:

PARAMETER VALUE	MEANING
E	The input file will be read in even parity.
O	The input file will be read in odd parity.

This parameter is not used if the input file is on disk.

## REELCNT-nn

(Optional; may be used only if the input file is on tape)

This parameter is used for specifying the number of reels of tape to be processed in the input file. The parameter-value field is numerical, and can be a maximum of two characters. The user punches the actual number in the value field.

If the value 99 is used, the following message will be issued on the console during the sort program's General Assignment Phase:

20303- REEL CNT

The operator must then enter the number of input reels that contain data to be sorted (see "Messages" in this section).

If this parameter is omitted, the sort will process input records until an end-of-file trailer label is recognized; if the files are unlabeled, the sort will process the records until the first tape mark is reached.

This parameter is not used if the input file is on disk.

#### REWIND-nnnn

(Optional; may be used only if the input file is on tape)

This parameter is used for specifying the iocs rewind options desired for the sort program input file. The four-character parameter-value field is alphabetic.

Each of the four parameter-value characters must be one of the following:

PARAMETER VALUE	MEANING
R	Rewind the tape reels
U	Rewind and unload the tape reels
N	Take no action

The character in the first (left-hand) parameter-value field position causes the iocs to perform the specified action (or no action) on the first reel of the input file, at the beginning of the reel. The character in the second position causes the iocs to act on all subsequent reels of the file, at the beginning of each reel. The character in the third position causes the iocs to act on all the reels of the file (except the last reel) when the end of each reel is reached. The character in the fourth position causes the iocs to act on the last reel of file when the end of that reel is reached.

If this parameter is included, all four selected characters must appear in the parameter-value field. If the parameter is omitted, the options RRUU are assumed.

This parameter is not used with disk input.

#### OUTPUTFILE Parameters

##### RECFORM-n

(Optional)

This parameter is used for specifying the record format of the output file. The single-character parameter-value field is numerical. If this parameter is omitted, the output records will have the same format as the input parameters. The possible values of "n" have the same meaning as in the RECFORM parameter on the INPUTFILE card.

##### OUTBLKNG-nnnn

(Required only for Form 1 and Form 2 records)

This parameter is used if the output file is to contain blocked fixed-length records, or unblocked fixed or variable-length records. In the first case, the parameter specifies the input blocking factor; in the second case, the parameter indicates, via a numerical code, whether or not the unblocked, variable-length records will contain record marks. The parameter-value field is numerical, with a maximum length of four characters. The following parameter values can be used:

PARAMETER VALUE	TYPE OF RECORDS
0000	Unblocked, fixed or variable-length records (Form 1), without terminal record marks.
0001	Unblocked, fixed or variable-length records (Form 1), with terminal record marks.
(Number of Data Records per Block)	Blocked, fixed-length records with terminal record marks (Form 2).

This parameter is not used for Form 4 records.

##### BLKLEN-nnnnn

(Required only for Form 4 records)

This parameter is used for specifying the maximum block length that will be present in an output file containing Form 4 records. The parameter-value field is numerical, with a maximum length of four characters. The user punches the actual figure in the value field.

The block length specified must include four positions for the Block Character-Count field. (Sort sets a plus sign in the junior position of this Block Character-Count.) Maximum output block length possible is described under "Output Specifications" in the "Features and Specifications" section.

This parameter is not used for Form 1 or 2 records.

##### LENMODREC-nnnnn

(Required only if the data record length is changed via Phase 3 modifications, or if record marks present on input will be deleted on output)

This parameter is used if either: (1) the data record length is changed through a Phase 3 user-written modification routine; or (2) the data record length is changed because of the dropping of the record mark on output. In the first case, the parameter specifies the changed input data record length for fixed-length records, or the changed maximum data record length for variable length records. In the second case, the parameter specifies the length of the output data record without the record mark. If the input is blocked, or unblocked with a record mark, and the output is to be unblocked without a record mark, this parameter must be used to specify the length of the output data record without the record mark. For these situations, the output

LENMODREC parameter provides the sort program with the length (or maximum length) of the output data records, and the RECLEN parameter gives the length of the data record with the record mark (see "Features and Specifications").

If the data record length specified is not changed by user-written modification routines in Phase 3, or by the deletion of a record mark on output, this parameter is not required. The parameter-value field is numerical, with a maximum length of four characters. The minimum and maximum values possible are described under "Output Specifications" in the "Features and Specifications" section.

#### REWIND-nnnn

(Optional; may be used only if the output file is on tape)

This parameter is used for specifying the IOCS rewind options desired for the sort program's output file. The four-character parameter-value field is alphabetic. The parameter options are identical to those for the REWIND parameter of the INPUTFILE control card. All four characters are required in the parameter-value field. If the parameter is omitted, the options RRUV are assumed.

The parameter is not used with disk output.

#### PARITY-n

(Optional; may be used only if the output file is on tape)

This parameter is used for specifying that the output file will be written in odd parity. The parameter may also be used to specify that the file be written in even parity; however, omission of the parameter will result in the file being written in even parity.

The single-character parameter-value field is alphabetic, and the following values can be used:

PARAMETER VALUE	MEANING
E	Even parity
O	Odd parity

This parameter is not used with disk output.

#### PADDING-n

(Optional)

This parameter is used for specifying the particular padding option desired with blocked, fixed-length output records. The single-character parameter-value field is alphabetic. For an ascending sort, a low padding record is one consisting of all blank characters (except for the terminal record mark), and a high padding record is one consisting of all nines (except for the terminal record mark). For a descending sort, records composed entirely of nines constitute low padding, and blank records are high padding.

If this parameter is not included, and blocked, fixed-length records are specified, Option A will be assumed. The possible options are as follows:

PARAMETER VALUE	MEANING OF OPTION
A	The program will not check for padding records. Added padding, if required, will be high padding.
B	The program will check for high padding only. High padding records in excess of the completed block will be dropped from the output file. Added padding, if required, will be high padding.
C	The program will check for low padding only. Full blocks of low padding will be dropped from the output file. Added padding, if required, will be low padding. However, if records are added or deleted during Phase 3, the program may be required to add high padding to the last output block.
D	The program will check for both high and low padding, and eliminate all low padding. High padding records in excess of the completed block will be dropped from the output file. Added padding, if required, will be high padding.
E	The program will check for both high and low padding. Full blocks of both high and low padding will be dropped. Added padding, if required, will be low padding. If high padding records are present in the input file, and the number is known to the user, he can effect the dropping of all high padding records. This is done by including a modification routine at exit P34; the user should place at linkage symbol DH62/ the number of high padding records that have entered the sort. However, if records are added or deleted during Phase 3, the program may be required to add high padding to the last output block. If the user wishes the sort program to start the high padding check earlier in Phase 3, he should place at linkage symbol DH62/ the number of records over the normal amount that should be checked.

For more information on the padding features of the sort program, see "Padding" in the "Features and Specifications" section.

#### CNTLFLDS Parameters

##### NUMBER-n

(Required)

This parameter specifies the number of control data fields on which the sort program is to be based. The single-character parameter-value field is numerical. The number inserted in the value field may be 1 to 9, or 0 (for ten control data fields).

##### LENGTH-nnnn

(Required)

This parameter specifies the total length of all control data fields. The parameter-value field is numerical, with a maximum length of four characters. The user punches the actual figure in the value field.

1LOC-nnnn

(Required)

This parameter specifies the location on the data record of the low-order position of the major control data field; the position number is based on the beginning of the data record. The parameter-value field is numerical, with a maximum length of four characters. The user punches the actual position number in the value field.

1LEN-nnn

(Required)

This parameter specifies the length of the major control data field. The parameter-value field is numerical, with a maximum length of three characters. The user punches the actual figure in the value field.

In the following parameters, all optional, the parameter-value fields are all numerical. In the LOC parameters, the parameter-value field has a maximum length of four characters, and specifies the location on the data record of the low-order position of the control data field: the position number is based on the beginning of the data record. In the LEN parameters, the parameter-value field has a maximum length of three characters, and specifies the length of the control data field.

2LOC-nnnn

(Optional)

Location of the second control data field.

2LEN-nnn

(Optional)

Length of the second control data field.

3LOC-nnnn

(Optional)

Location of the third control data field.

3LEN-nnn

(Optional)

Length of the third control data field.

4LOC-nnnn

(Optional)

Location of the fourth control data field.

4LEN-nnn

(Optional)

Length of the fourth control data field.

5LOC-nnnn

(Optional)

Location of the fifth control data field.

5LEN-nnn

(Optional)

Length of the fifth control data field.

6LOC-nnnn

(Optional)

Location of the sixth control data field.

6LEN-nnn

(Optional)

Length of the sixth control data field.

7LOC-nnnn

(Optional)

Location of the seventh control data field.

7LEN-nnn

(Optional)

Length of the seventh control data field.

8LOC-nnnn

(Optional)

Location of the eighth control data field.

8LEN-nnn

(Optional)

Length of the eighth control data field.

9LOC-nnnn

(Optional)

Location of the ninth control data field.

9LEN-nnn

(Optional)

Length of the ninth control data field.

0LOC-nnnn

(Optional)

Location of the tenth control data field.

0LEN-nnn

(Optional)

Length of the tenth control data field.

#### **LABELDES Parameters**

The following parameters enable the user to communicate to the IOCS, through the sort program, the tape-label information he wishes to include in the File Table Extensions for the tape input and/or output files. The LABELDES card is used only if the input and/or output is on tape and the tapes contain labels. If the LABELDES card (with required TYPELABEL parameter) is included, the sort program will: (1) indicate in each tape File Table used that tape labels are to be processed; and (2) supply the address of the appropriate input or output File Table Extension. Leading zeros in numeric parameter-value fields cannot be omitted.

Sort programs provide none of the label-handling routines; they only move the desired information to the appropriate File Table Extensions. The user should determine the function, use, and applicability of each of the parameters for his processing needs by con-

sulting the publication *Basic Input/Output Control System*.

#### TYPELABEL-n

(Required if the LABELDES card is used; i.e., if tape labels are to be processed)

This parameter specifies the type of tape labels used for the sort files. The single-character parameter-value field is numerical and the following values can be used.

PARAMETER VALUE	MEANING
1	IBM 1410 80-character labels will be processed
2	IBM Standard 120-character labels will be processed
3	Nonstandard labels will be processed

NOTE: The File Table Extensions are initialized for IBM 80-character labels, and are changed only if IBM Standard 120-character labels are specified.

The following six optional parameters provide File Table Extension information for a tape input file.

#### ICHCKLBL-nnnnnnn

This parameter specifies tape-label fields that should be checked. Each character in the six-character, alphabetic parameter-value field may be:

PARAMETER VALUE	MEANING
Y	Check
N	Do not check

The six-character positions (from left to right) in the parameter-value field stand for the following tape-label fields:

- 1st Position — Retention period
- 2nd Position — Creation date
- 3rd Position — File identification
- 4th Position — File serial number
- 5th Position — Reel sequence number
- 6th Position — Block count

NOTE: The sixth position should be checked (parameter value of Y) when processing labeled multi-reel files.

#### IRTNOCYCLE-nnn (or nnnn)

The user punches the retention period (number of days) in the parameter-value field. The number should be three characters for 80-character tape labels, or four characters for 120-character tape labels.

#### ICREATDATE-nnnnn

The user punches the creation date in the five-character parameter-value field.

#### IFILEIDENT-nnnnnnnnnnn

The user punches the file identifier in the ten-character parameter-value field. The program allows the user to specify this field as he desires, and include file identifiers containing comma, blank, and hyphen characters; however, two restrictions must be observed: the parameter-value field of this parameter

must be ten characters in length, and the parameter must always be followed by a comma, even if it is the last parameter on a card.

#### ISERIALNO-nnnnn

The user punches the file serial number in the five-character parameter-value field.

#### IREELSEQ-nnn (or nnnn)

The user punches the reel sequence number in the parameter-value field. The number is three characters for 80-character tape labels, and four characters for 120-character labels.

The following six optional parameters provide File Table Extension information for the output file. The specifications for each parameter are the same as those for the equivalent parameter for the input file.

#### OCHCKLBL-nnnnnnn

Tape-label field checking options.

#### ORTNOCYCLE-nnn (or nnnn)

Retention period.

#### OCREATDATE-nnnnn

Creation date.

#### OFILEIDENT-nnnnnnnnnnn

File identifier.

#### OSERIALNO-nnnnn

File serial number.

#### OREELSEQ-nnn (or nnnn)

Reel sequence number.

## Operating Information

The purpose of this section is to explain and summarize, through the use of examples, the preparatory procedures necessary for the running of an unmodified sort program. The "Program Modification" section discusses considerations necessary for the running of sort programs that contain user-written modification routines.

### Sort Program Example

#### Assumptions

1. *Input File Characteristics* for the sort program SORTPROC are: The user's input file is on disk. The records are of the card image type, 80 characters each, and each with a record mark in the eightieth position. The input blocking factor is 35.

2. *Sort Characteristics Desired by the User* are: The records are to be sorted in descending collating sequence on five control data fields. These fields, in the order in which they are to be sorted on, are: Columns 60-75, Columns 6-15, Columns 49-59, Columns 4-5, and

Columns 26-30. The user desires that checkpoints be taken, and that the Write Disk Check feature be used on input and during the sort. Records containing uncorrectable errors should be processed as if they were error-free. On input, the disk records will be read using the IOCS routines for Form A (Sequential-Full Track) disk files. The number of records in the input file has been established in the preceding program. The output will be on two tape units; the output file will contain Form 2 fixed-length records, and the output blocking factor is 20. The user wishes to eliminate any excess high padding in the input file, and retain enough high padding for the output file to complete the last block. The output file will use IBM 1410 80-character tape labels, and the user wishes to check the retention cycle and label his tape PERSON-1. He desires the standard rewind options for the output tape units.

The user had defined the sort program during system generation, and the program resides on the sor. To define the program, the following Sort Definition card had been used:

```
Col 6      16      21
  SORTPROG DSORT  IND
```

NOTE: In the Sort Definition card above, the parameter INDISK has been shortened to its first three characters. Since the other sort definition aspects of the intended program (output file on tape, several control data fields, fixed-length records, and no modifications) corresponded to alternatives that would be assumed if the remaining alternative of the respective set was not specified, IND (INDISK) was the only parameter required in the parameter-list field.

The following Unit Definition card had been used:

```
Col 6      16      21
  DUNIT  MR1,MR4,MR2,MR3
```

NOTE: According to the specifications in this card, the symbolic unit designations are as follows: input—MR1, output—MR4, first disk work area—MR2, second disk work area—MR3.

Prior to the execution of a sort program as part of a job, the user must assign physical disk areas and tape units (if tape is specified for input and/or output) to the symbolic units designated in the Unit Definition card. Various assignment considerations for a disk sort are discussed in the "Program Definition" section.

Assume that in this example the user has two modules of disk storage; on Module 0, disk areas D1, D2, D3, and D4 are available for the work files of the sort. On Module 1, disk areas E5 and E6 are available. Each disk area, defined at system generation, consists of ten cylinders. Magnetic tape units A3 and B2 are available for the output from the sort.

In this example, the input file occupies disk areas E1, E2, E3, and E4. The sort itself will require 28 cylinders in disk storage Module 0, and 19 cylinders in Module 1.

#### ASGN Cards and EXEQ Card

The following System Monitor ASGN cards can be used for this program:

```
Col 6      16      21
  MON$$$  ASGN  MR1,E1,E2,E3,E4
  MON$$$  ASGN  MR4,A3,B2
  MON$$$  ASGN  MR2,D1,D2,D3
  MON$$$  ASGN  MR3,E5,E6
```

These cards must precede the System Monitor EXEQ card, which would be as follows:

```
Col 6      16      21
  MON$$$  EXEQ  SORTPROG
```

The program name beginning in column 21 is the name that was specified in columns 6-15 of the Sort Definition card.

#### Sort Program Control Cards

The user bases his selection of parameters for the sort program control cards on the characteristics of the input file, the options desired, the desired form of the output file, and the physical units available. The sort program control cards are placed in the siu after the System Monitor EXEQ card for the sort program to be executed. In the case of SORTPROG, the sort control cards shown in Figure 5 could be used.

#### NOTES:

1. The following parameters have been omitted because their exclusion will result in the desired option being assumed: ERROPTION (SORTTYPE card); DISKRD-MODE (INPUTFILE card); RECFORM (OUTPUTFILE card), REWIND (OUTPUTFILE card), and PARITY (OUTPUTFILE card).

2. The following parameters have been shortened: IBLOCKCOUNT (INPUTFILE card), PADDING (OUTPUTFILE card), TYPELABEL (LABELDES card), and OCHCKLBL (LABELDES card).

3. The OFILEIDENT parameter (LABELDES card) is one of the two parameters whose value fields may contain hyphens and blanks as shown in the example above. Note that this parameter is followed by a comma even though it is the last parameter in the card (see "LABELDES Parameters").

#### Phase Concept for Separate Programs

Normally, a sort is executed as a program separate from the preceding and following programs within the same job. If, however, the user desires to retain information in core storage from one program to the

Line	Label	Operation	OPERAND											
3	5	15	20	25	30	35	40	45	50	55	60	65	70	
0.1	SORTTYPE	SORT	RECL	EN-80	,DESC	END-D	,CHKP	0INT	-Y	,WRIT	DSKCHK	-Y		
0.2	INPUTFILE	SORT	REC	F0RM-2	,INP	BLKNG	-35	,IBL	-1PI					
0.3	OUTPUTFILE	SORT	0UT	BLKNG	-20	,PAD	-B							
0.4	CNTLFIDS	SORT	NUMBER	-5	,LENGTH	-44	,1L0C	-75	,1LEN	-16	,2L0C	-15	,2LEN	-10
0.5	CNTLFIDS	SORT	3L0C	-59	,3LEN	-11	,4L0C	-5	,4LEN	-2	,5L0C	-30	,5LEN	-5
0.6	ELABELDES	SORT	TYPE	-1	,0CHK	CK-YN	NNNN	,0FILE	IDENT	-PERS	0N-1			
0.7														

Figure 5. Sort Control Cards for SORTPROG Example

next, the programs must be relocated through the Linkage Loader as phases of one large program. One method of accomplishing this is shown in Figure 6.

The end-of-sort exit (P33), described in "Program Modification," must be used to provide the link to the next program phase.

col	6	16	21
	MON\$\$	EXEQ	DSRTDEFINE
	(no name)	DSORT	(parameters)
		DUNIT	(parameters)
		:	
	MON\$\$	EXEQ	LINKLOAD
		PHASE	(Overall program name)
		CALLN	(Preceding program modules)
		.	
		.	
		INPUT	MW2
		PHASE	
		CALLN	(Following program modules)
		CALLN	
		etc.	

Figure 6. Example — Control Cards for Producing a Sort Program as a Phase of One Large Program

### Unusual End of Program

During the execution of a sort program, the contents of certain Resident Monitor fields (such as the /IPI/ field) are altered through the use of the /MCR/ Resident Monitor routine. If the return from /MCR/ is made to the error return address, an unusual-end-of-program condition will result; the sort program will unconditionally go to the Resident Monitor /UEP/ routine. This is the only situation in which the /UEP/ routine is used by the sort program. /MCR/ and /UEP/ are described in the publication *System Monitor*.

### Sort Program Messages

#### General Information

The meanings of the messages that a sort program may produce during its operation are explained in this section.

Whenever action is required following a message, the program will enter a waiting loop. To assist the operator in analyzing the conditions that exist when a waiting loop occurs, all console printer and SPR messages will contain a five-digit identification code at the beginning of the message. The significance of each position, and the meanings of the numbers that may be used in that position, are described in the following paragraphs.

#### Ten-Thousands Position (High-order position)

The digit in this position indicates the condition that exists at the time the waiting loop and/or message occurs. It also specifies the types of action possible.

DIGIT	MEANING
0	Indicates a "cannot proceed" condition (equivalent to a "dead-end halt" condition in a program outside the Operating System). The program will indicate to the Resident Monitor that, unless the programs are in TEST mode, subsequent programs within the same job should not be executed and the System Monitor should skip to the next job. Processing does not stop and no waiting loop is entered.
1	Indicates an occurrence of possible significance, such as the commencement or conclusion of a particular portion of the program. The message is primarily of diagnostic value. It is not accompanied by a waiting loop.
2	Indicates an "await-action" condition, and a waiting loop is provided. Messages appear on both the console printer and the SPR. Only one course of action per message can be followed by the operator to continue the program. The operator also has the option of terminating the program.
3	Indicates an "await-action" condition, and a waiting loop is provided. Messages appear on both the console printer and the SPR. Two courses of action are possible to continue the program. The operator also has the option of terminating the program.

#### Thousands Position

This will always be a zero.

#### Hundreds Position

This will always be a three, indicating a sort program message.

### Tens Position

The digit in this position indicates the phase to which the message pertains.

DIGIT	MEANING
0	General Assignment Phase
1	Phase 1
2	Phase 2
3	Phase 3

### Units Position

The digit in this position is an arbitrarily assigned number serving to differentiate the various conditions having identification codes that start with the same four digits.

### Messages

- 00301 *Console:* 00301  
*SPR:* 00301- SORT DELETED DUE TO ERROR IN CONTROL DATA ... (specific error) ...  
*Explanation:* The control card diagnostic routine has detected an uncorrectable error in the control data supplied by the user. The specific error is indicated in the SPR message.  
*Action:* No operator action possible. The user must correct the control card in error and re-execute the program.
- 00302 *Console:* 00302  
*SPR:* 00302- INVALID CARD TYPE, COLUMNS 6-8 ... (card in question) ...  
*Explanation:* The card-type field of the displayed control card (printed in its entirety) does not designate a valid card type.  
*Action:* No operator action possible. The user must correct the card in error and re-execute the program.
- 00303 *Console:* 00303  
*SPR:* 00303- PARAMETER NOT FOUND ... (card in question) ...  
*Explanation:* A parameter label on the displayed control card (printed in its entirety) is not a valid name and the control information cannot be properly set up for the sort program.  
*Action:* No operator action possible. The user must correct the control card in error and re-execute the program.
- 00304 *Console:* 00304  
*SPR:* 00304- INVALID PARAMETER ... (card in question) ...  
*Explanation:* One of the parameter fields on the displayed control card (printed in its entirety) is in error and the control information cannot be properly set up for the sort program.  
*Action:* No operator action possible. The user must correct the control card in error and re-execute the program.
- 00305 *Console:* 00305  
*SPR:* 00305- PARAMETER FIELD TOO LONG ... (card in question) ...  
*Explanation:* One of the parameter fields on the displayed control card (printed in its entirety) is longer than permissible and cannot be processed by the sort program.  
*Action:* No operator action possible. The user must correct the control card in error and re-execute the program.
- 00311 *Console:* 00311  
*SPR:* 00311- INSUFFICIENT CORE STORAGE PHASE 1  
*Explanation:* The amount of core storage actually avail-

able for the sort during Phase 1 is less than the amount required for execution.

*Action:* No operator action possible. The user must reduce the size of routines sharing core storage with Phase 1, or reduce the Phase 1 core-storage requirements by reducing the input block length. He must then re-execute the program.

- 00314 *Console:* 00314  
*SPR:* 00314- NMAX EXCEEDED  
*Explanation:* The number of data records processed by Phase 1 up to this point exceeds the maximum number of records that can be stored (NMAX), as stated in message 10315.  
*Action:* The sort must be restarted from the beginning; either the number of input records must be reduced or the amount of disk storage available to the sort must be increased.
- 00315 *Console:* 00315- NO INPUT DATA  
*SPR:* None  
*Explanation:* The input tape to the sort program does not contain any data records.  
*Action:* No operator action possible. The user should check that the correct physical unit has been assigned to the symbolic unit for input.  
*NOTE:* For any succeeding program depending on output from this sort as input, unknown conditions may occur since the output unit has not been initialized.
- 00321 *Console:* 00321  
*SPR:* 00321- INSUFFICIENT CORE STORAGE PHASE 2  
*Explanation:* The amount of core storage actually available for the sort during Phase 2 is less than the amount required for execution.  
*Action:* No operator action possible. The user must reduce the size of the routines sharing core storage with phase 2 and re-execute the program.
- 00331 *Console:* 00331  
*SPR:* 00331- INSUFFICIENT CORE STORAGE PHASE 3  
*Explanation:* The amount of core storage actually available for the sort during Phase 3 is less than the amount required for execution.  
*Action:* No operator action possible. The user must reduce the size of the routines sharing core storage with Phase 3, or reduce the Phase 3 core-storage requirements by reducing the output block length, and re-execute the program.
- 00332 *Console:* 00332  
*SPR:* 00332- OUT OF SEQUENCE  
*Explanation:* A record has been found to be out of sequence in the Phase 3 output.  
*Action:* No operator action possible. An out-of-sequence condition is usually indicative of operational failure or invalid input.
- 00334 *Console:* 00334  
*SPR:* 00334- OUTPUT DISK SPACE EXCEEDED  
*Explanation:* During Phase 3, all the disk space assigned for the output file has been filled with records and has reached end of file before the entire input file has been processed.  
*Action:* No operator action possible. The user must reduce the file size, or increase the disk area assigned for the output file, and re-execute the program.
- 10301 *Console:* None  
*SPR:* 10301- XXXXXXXX  
*Explanation:* Program identification message. XXXXXXXX is the eight-character identification field from columns 73-80 of the first sort control card.  
*Action:* None required.



- 10306 *Console:* None  
*SPR:* 10306- NOT ALL SAME USER IDENT...  
(card in question) ...  
*Explanation:* Columns 73-80 of the displayed control card (printed in its entirety) do not agree with those of the previous card.  
*Action:* None required.
- 10307 *Console:* None  
*SPR:* 10307- WORK AREAS A AND B INTER-CHANGED  
*Explanation:* The area designated as work area A is smaller than the area designated as work area B. Since the larger area is always considered "A," the designations have been interchanged.  
*Action:* None required.
- 10310 *Console:* None  
*SPR:* 10310- END PHASE 1, XXXXXXXX - SEQUENCES, YYYYYYY - RECORDS OUT  
*Explanation:* General diagnostic message issued at the completion of Phase 1 of the sort. XXXXXXXX is the number of sequences produced and YYYYYYY is the total number of records processed during Phase 1.  
*Action:* None required.
- 10311 *Console:* None  
*SPR:* 10311- SKIP PHASE 2  
*Explanation:* The number of sequences produced by Phase 1 is less than or equal to the Phase 3 maximum merge order. Phase 2, therefore, will be bypassed.  
*Action:* None required.
- 10315 *Console:* None  
*SPR:* 10315- NMAX - XXXXXXXX, G-YYYY, B-ZZZZ  
*Explanation:* General diagnostic message stating the maximum file size possible (NMAX), the number of records that can be internally sorted at one time (G), and the sort blocking factor (B).  
*Action:* None required.
- 10320 *Console:* None  
*SPR:* 10320- END PHASE 2  
*Explanation:* General diagnostic message issued at completion of Phase 2.  
*Action:* None required.
- 10321 *Console:* None  
*SPR:* 10321- END PASS XXXX SEQUENCES OUT  
*Explanation:* General diagnostic message at completion of each pass of Phase 2 of the sort. XXXX is the number of sequences produced by the pass.  
*Action:* None required.
- 10331 *Console:* 10331- OUTPUT CU  
*SPR:* None  
*Explanation:* The output file has been written on tape. The first output reel is identified as CU.  
C is the channel.  
U is the unit.  
*Action:* None required.
- 10332 *Console:* None  
*SPR:* 10332- LO PAD ADD TTT LO PAD DROP UUUU HI PAD ADD VVV HI PAD DROP WWWW TOTAL RCDS XXXXXXXX INCL YYY LO PAD ZZZ HI PAD END SORT  
*Explanation:* The sort has been completed. The record and padding counts have been recapitulated as follows:  
TTT low padding records have been added.  
UUUU low padding records have been dropped.  
VVV high padding records have been added.  
WWWW high padding records have been dropped.
- XXXXXXX records have been written on the output file.  
YYY low padding records are included in the output.  
ZZZ high padding records are included in the output.  
*Action:* None required.  
NOTE: This message will be issued only if fixed-length records are being processed. If sort is processing variable-length records, the following message will be given on the SPR:  
10332- TOTAL RCDS XXXXXXXX END SORT  
*Explanation:* The sort has been completed. XXXXXXXX records have been written on the output file.  
*Action:* None required.
- 10333 *Console:* 10333- LAST TRACK AMTTTTHH, NUMBER OF WRITES XXXXX  
*SPR:* 10333- LAST TRACK AMTTTTHH, NUMBER OF WRITES XXXXX  
*Explanation:* The output file has been written in disk storage. AMTTTTHH is the disk address word for the last track of the output file.  
A is the access mechanism.  
M is the module.  
TTTT is the track address.  
HH is the home address identifier (HA2).  
*Action:* None required.
- 20301 *Console:* 20301- ... (Field) .....  
(Suggested Value) ..  
*SPR:* 20301- SORT CONTROL INFORMATION CHANGED IF RUN GOES... (specific error) ...  
*Explanation:* The control card checking routine has detected an error or inconsistency in the control data supplied by the user, as indicated in the SPR message. If the option to continue the sort is taken, the field indicated in the console message will be altered to the suggested value shown in the console message.  
*Action:* Press INQUIRY REQUEST, then type:  
\$31 - to accept the suggested value and continue execution.  
\$32 - to reject the suggested value and cause the sort to terminate as with a "cannot proceed" condition.  
Then press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.
- 20302 *Console:* 20302- N GREATER THAN NMAX  
*SPR:* 20302- N GREATER THAN NMAX  
*Explanation:* The file size specified by the user is greater than the sort capacity stated in the message 10315.  
*Action:* Press INQUIRY REQUEST, then type:  
\$31 - to proceed with the sort as though the file size had not been specified.  
\$32 - to cause the sort to terminate as with a "cannot proceed" condition.  
Then press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.
- 20303 *Console:* 20303- REEL CNT  
*SPR:* None  
*Explanation:* The operator must enter the number of reels to be sorted.  
*Action:* Press INQUIRY REQUEST, then type:  
\$31nn - where nn is the number of input reels to be sorted.  
Then press INQUIRY RELEASE.
- 20311 *Console:* 20311- RCD CNT OFF  
*SPR:* 20311- I/P XXXXXXXX RECORDS, NOT N GIVEN  
*Explanation:* In reconciling the Phase 1 input record count XXXXXXXX against the file size specified by the

user, the program found the counts to be unequal. This may be due to an incorrect file size being specified, an operational failure, or the skipping of unreadable records if the skip option (ERROPTION-S in the SORTTYPE control card) had been specified to the IOCS.

*Action:* Press INQUIRY REQUEST, then type:

\$31 — to accept the sort record count and continue processing.

\$32 — to cause the sort to terminate as with a “cannot proceed” condition.

Then press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.

20312 *Console:* 20312- RCD CNT OFF

*SPR:* 20312- PHASE 1 DATA RECORD COUNTS  
OUT OF BALANCE XXXXXXXX-IN, YYYYYYY-OUT

*Explanation:* Phase 1 data record counts do not balance. XXXXXXXX is the number of input records plus the number added by the user minus the number deleted by the user. YYYYYYY is the number of data records written in Phase 1.

*Action:* Press INQUIRY REQUEST, then type:

\$31 — to accept the sort record count and continue processing.

\$32 — to cause the sort to terminate as with a “cannot proceed” condition.

Then press INQUIRY RELEASE. The typing of any other digit will not break the waiting loop.

20321 *Console:* 20321- RCD,CNT OFF

*SPR:* 20321- XXXXXXXX IN YYYYYYY OUT, RE-  
CORD COUNT OFF

*Explanation:* In reconciling the record count at the end of a Phase 2 pass, the program found the output count (YYYYYYY) to be unequal to the input count (XXXXXXX). This may be due to operational failure.

*Action:* Press INQUIRY REQUEST, then type:

\$31 — to accept the new record count (YYYYYYY) and continue processing.

\$32 — to cause the sort to terminate as with a “cannot proceed” condition.

Press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.

20331 *Console:* 20331- RCD CNT OFF

*SPR:* 20331- XXXXXXXX IN YYYYYYY OUT, RECORD  
COUNT OFF

*Explanation:* In reconciling the record count at the end of Phase 3, the program found the output count (YYYYYYY) to be unequal to the input count (XXXXXXX). This may be due to operational failure.

*Action:* Press INQUIRY REQUEST, then type:

\$31 — to accept the new record count (YYYYYYY) and continue processing.

\$32 — to cause the sort to terminate as with a “cannot proceed” condition.

Press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.

30301 *Console:* 30301- ... (Columns 16-20 of the card) ...

*SPR:* 30301- NOT SORT CONTROL CARD ....  
(card in question) .....

*Explanation:* A card, read by the control card reading routine, does not contain the identification, SORTb, in columns 16-20.

*Action:* Press INQUIRY REQUEST, then type:

\$31 — to accept the card in question, and attempt to process it.

\$32 — to reject the card and cause the sort to terminate as with a “cannot proceed” condition.

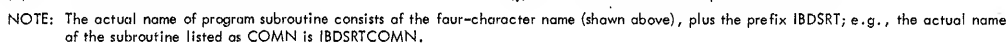
\$33 — to bypass the card and attempt to continue execution of the program.

Then press INQUIRY RELEASE. The typing of any other units digit will not break the waiting loop.

Figure 7 shows the subroutines that may appear in each phase in a created sort program. The junctures at which added programming can be included, if the appropriate exit point is activated, are also shown.

Acting upon information contained in the Sort Definition control cards, the Sort Definition Program selects the appropriate subroutines for the type of program desired. The name of the Sort Definition Program within the computer system is DSRTDEFINE. It is initialized to define a program that will sort fixed-length records with multiple control data fields, have no user-written modification routines, and use magnetic tape input and output. Each of these parameters will be assumed unless the alternative parameter of the respective set is specified (see "Program Definition").

When executed, the Sort Definition Program will read the control cards (DSORT and DUNIT cards) and produce a series of PHASE, BASE, and CALLN statements on symbolic unit `mw2`; these statements then serve as input to the Linkage Loader, which produces the desired sort program in absolute format. By specifying the parameter `PCN` on the Sort Definition control card, the user can also cause the Sort Definition Program



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to place its output (the definition statements) on the Standard Punch Unit (SPU); this punched output can subsequently be placed on the SPU and used as input from that unit to the Linkage Loader.

The program is written by the Linkage Loader in absolute format on the SPU or Job file, depending on whether the Sort Definition Program is executed during system generation or system operation. By producing absolute sort programs at system generation, the user can eliminate the need for executing the Sort Definition Program and Linkage Loader each time a sort is to be run.

## **Sort Program**

### **General Assignment Phase**

The General Assignment Phase precedes the three main phases of a created sort program, and is the first phase to be executed. The primary functions of this phase are as follows:

1. Reserve the common area used by all phases of the sort program, and initialize fields within the common area.
2. Read the user's control cards.
3. Check the information provided by the control cards for validity and consistency.
4. Convert the control card information to the form in which the sort program will use it, and place the converted data in the Sort Control Information Area in Sort Common.
5. Perform any calculations or further action required for the information provided by the control cards, and enter the results in the appropriate Sort Common fields.

The control cards are read from the SPU and may take the form of cards, or card images on tape.

### **Phase 1**

Phase 1 performs the initial sequencing of the input file. This phase uses binary insertion routines, a memory-to-memory tag merge (if required), and a memory-to-disk merge to produce, on disk, sequences "G" data records long (G is the number of data records that can fit in the Record Storage Area at one time). Each block of records written on disk contains "B" data records (B is the sort blocking factor). Phase 1 is divided into two parts: the assignment program and the running program.

#### **Assignment Program**

The Phase 1 assignment program sets up the running program in accordance with the information specified by the user in the sort program control cards. The main functions performed by the assignment program are as follows:

1. Calculates the number of 1301 or 2302 disk tracks available for working storage. Optimum efficiency is attained if each of the two work areas is on a different module (1301 Disk Storage), or each access arm of the same module services a different work area (2302 Disk Storage). These considerations are discussed in detail in "Features and Specifications" and "Program Definition."

2. Computes the sort blocking factor (B). B is equal to the integral value of 2,800 divided by the data record length (or, for variable-length records, the maximum data record length).

3. Calculates the number of data records that can fit in the Record Storage Area at one time (G); this is the number of records that can be internally sorted at one time. G is determined by the number of core-storage positions available.

4. Establishes the starting addresses for the data areas.

5. Calculates the maximum merge orders for Phases 2 and 3. These merge orders need not be the same. The calculation is based on the number of core-storage positions available in each of these phases.

6. Calculates the maximum number of data records that can be sorted using the given configurations and under the given conditions.

7. Initializes the Phase 1 output disk track addresses.

8. Initializes the internal merge network as required.

9. Clears the data areas and sets the word marks as required.

### **Running Program**

The Phase 1 running program consists of a series of sort cycles. The execution of each sort cycle entails: (1) binary insertion; and (2) internal merging.

The binary insertion routines create sequences of up to 12 data records each. The internal merge process can consist of one or two parts: a memory-to-memory tag merge (if required) and a memory-to-disk merge. Each merge operation within each of these parts merges up to 12 sequences; the result of the memory-to-disk merge is a single sequence of all the records in the Record Storage Area.

The running program refers to the data records through the use of tags, thereby avoiding unnecessary movement of data records. A tag consists of the five-character address of the first position of a data record in the Record Storage Area. All compare instructions refer to the low-order position of a control data field and are indexed by the tags.

**Binary Insertion Routines:** The binary insertion routines begin with the initialization of the Record Storage Area. Tags for the first two data records are

created and placed in the index registers in proper sequence. As each new tag is created, it is inserted in the proper order in the index registers; a binary search technique is used to determine the proper location of each new tag. Reading operations continue concurrently with processing until the Record Storage Area has been filled. Each time a full sequence of tags has been created in the index registers (the maximum sequence length is 12), the tag sequence is moved to a tag storage area and the routine re-initialized for creating the next tag sequence. This procedure continues until all records in the Record Storage Area have been processed.

*Internal Merge:* The memory-to-memory tag merge, if utilized, constitutes the first part of the internal merge. If the number of sequences produced by the binary insertion routines is equal to or less than 12, the memory-to-memory merge may be bypassed. The second part of the internal merge is the memory-to-disk merge; this operation merges the sequences already created and writes them as one sequence on disk storage.

The memory-to-memory tag merge repetitively determines the next sequential record, and moves the tag for that record to a tag storage area; here the tag becomes part of one of the tag sequences to be used as input to the second merge pass (the memory-to-disk merge).

The memory-to-disk merge repetitively determines the next sequential record, and uses the record tag in moving the record to the output area. A write linkage to iocs is executed as soon as the output area is filled with data records. Merging continues while the writing operations are taking place; after an output area has been filled, the records being merged are placed in the alternate output area.

Upon completion of the memory-to-disk merge, all the records in the Record Storage Area will have been written in one sequence on disk. The program then returns to the binary insertion routines to begin the next sort cycle. The next output sequence is written on the other disk work area, and this alternate process continues. The entire output from Phase 1 is thus distributed on both work area A and work area B.

*Determination of the Next Phase:* After all the records in the input file have been read, processed, and written on the two disk work areas, the input and output data record counts for Phase 1 are checked. The program then determines whether or not Phase 2 should be executed. If the number of Phase 1 output sequences is greater than the maximum merge order for Phase 3, a linkage to the System Monitor for loading of Phase 2 is executed. If the number of Phase 1 output sequences is equal to or less than the maximum

merge order for Phase 3, a linkage to the System Monitor for loading Phase 3 is executed.

## **Phase 2**

Phase 2, if utilized, merges the output sequences until the total number of sequences is less than or equal to the Phase 3 maximum merge order. One or more passes may be required to perform this function. This phase consists of an assignment program and a running program.

### **Assignment Program**

The main functions performed by the Phase 2 assignment program are as follows:

1. Initializes the running program routine that assigns the input and output disk-track addresses.
2. Sets up the merge network according to the maximum Phase 2 merge order, and initializes all compare instructions involving the major control data field.
3. Determines the starting addresses for the data areas. Two output areas will be used. One input area will be used for each input merge sequence, and an additional, or alternate, input area is used for overlapping input with processing. The input-processing overlap is accomplished through a look-ahead routine.

### **Running Program**

The Phase 2 running program begins with the assignment of input and output track addresses, and initialization of counters and of input areas. The look-ahead routine examines the last record of each input block to determine which input area will be the first to have all its records merged into the resulting output sequence (i.e., the first block to empty). A read linkage to iocs is issued; this read is addressed to the next input block in the merge sequence from which the "first-to-empty" block came. While the merging operations are going on, the iocs will read this next block into the alternate input area.

The merge network refers to the data records through the use of tags located in the index registers. There is one tag for each input merge sequence; each tag consists of the five-character address of the first position of the data record next to be merged from that sequence, with zone bits in the tens and hundreds positions to identify the input merge sequence. All compare instructions refer to the low-order position of a control-data field and are indexed by the tags. After the next sequential record is determined, the tag for that record is used to move the record to the output area.

When the input block, predetermined by the look-ahead routine as the first to empty, has its last record moved to the output area, all references to the emptied area are switched to the alternate area; similarly, the

references to the alternate area now apply to the emptied area, which becomes the new alternate area. The look-ahead routine again determines which block in the input areas will be the first to empty; the linkage to rocs is executed, and a block of records from the appropriate merge sequence (the sequence that supplied the block that will be first to empty) is read into the alternate area. The read operation takes place while records in the other input areas are being merged. If a block that the look-ahead routine determines to be the first to empty contains a sequence break indication at the end, the program, upon detecting the indication, will remove the current alternate area from the look-ahead list. (The alternate area will, in this case, contain a block from the next set of sequences to be merged; records in this area are not involved in merging operations until all the records in the current set of sequences have been merged.) The look-ahead routine is then executed; in this and succeeding executions, the look-ahead routine will not examine the area removed from the list until all the records in the current set of sequences have been merged. In effect, each time a sequence break occurs, the look-ahead routine subsequently examines one less area in determining which block will be first to empty. When a one-way look-ahead occurs, the records in the block concerned (and succeeding blocks, if any, in the remaining input merge sequence) are moved to the output area. At this point, the input areas have been almost completely set up for the merging of the next group of sequences.

A write linkage to rocs is executed as soon as an output area is filled with data records. Merging continues while the writing operations are taking place; the records being merged are moved to the alternate output area.

When one full output sequence has been written on disk, the program returns to the disk-track assignment routines to complete the setting up for the next merging process. The input disk records for this next merging process will reside in a different portion of the same disk work area onto which the previous output sequence was written. The look-ahead routine is executed as described above. The output sequence from this merge will be written on the disk space that had contained the input records used in the initial Phase 2 merge. This alternate use of each of the work areas for merging continues throughout Phase 2.

Upon completion of a full Phase 2 pass (i.e., when all data records have been processed once), the program checks the input and output data record counts. If the number of output sequences is equal to or less than the Phase 3 maximum merge order, a linkage to the System Monitor for loading Phase 3 will be execu-

ted. If the number of output sequences is not equal to or less than the Phase 3 maximum merge order, a second Phase 2 pass will be initiated. If, upon completion of two Phase 2 passes, the number of output sequences is still greater than the Phase 3 maximum merge order, Phase 2 will be reloaded and re-executed. The necessity for reloading Phase 2 for a three-pass merge stems from the fact that this phase has been optimized as a two-pass system; only sorts with an exceedingly large file size will require more than two Phase 2 passes.

### **Phase 3**

Phase 3 performs the final merge pass for the sort and produces an output file in the format specified by the user. As in the case of Phases 1 and 2, Phase 3 consists of an assignment program and a running program.

#### **Assignment Program**

The main functions performed by the Phase 3 assignment program are as follows:

1. If the output file consists of fixed-length records, the assignment program sets up the routines for handling padding records according to the padding option specified.

2. Determines the starting addresses for data areas. Two output areas will be used. One input area will be used for each input merge sequence and an additional input area is set aside for overlapping input with processing. (The Phase 2 running program description explains the operation of the look-ahead routine.)

3. Sets up the merge network according to the number of input merge sequences entering Phase 3. This number may be less than or equal to the Phase 3 maximum merge order. Running program instructions and constants are set up as required. All compare instructions that involve the major control-data field are initialized.

4. Sets up the input areas using the starting addresses previously determined. The input areas are primed. The first data record of each input block is examined, and the relative order of these records is established.

5. The look-ahead routine in the running program is executed, using an alternate area in a manner similar to that described in Phase 2.

6. Sets up an output area (Output Area 2). If required, low padding records are added to the first output block. Merging then begins.

7. When the first non-low padding record is ready to be moved to Output Area 2 (Output Area 2 is always the first area written), Output Area 1 is set up.

### **Running Program**

The Phase 3 merge network is similar to the merge network used in Phase 2; the data records are referred to indirectly through the use of tags located in the index registers. There is one tag for each input merge sequence; each tag consists of the five-character address of the first position of the data record next to be merged from that sequence, with zone bits in the tens and hundreds positions to identify the input merge sequence. All compare instructions refer to the low-order position of a control-data field, and are indexed by the tags. After the next sequential record is determined, the tag for that record is used to move the record to the work area. A sequence check will be made on all records moved to the work area to insure that the final sort output file is in correct sequence. The operation of the look-ahead routine and related procedures are the same as described for Phase 2.

A write linkage to iocs is executed as soon as an output area has been filled with data records. Merging continues while the writing operations are taking place; the records next merged are moved to the alternate output area. All records are written out on the disk area designated for the output file.

If fixed-length records are being processed, and the user has specified through one of the padding options that the program check for high padding records, the check is made prior to the writing of the last block of records. The user may also, through a modification routine at exit P34, cause the padding check to be initiated earlier (see "Features and Specifications"). If the user has specified that no check be made, but that high padding be added, if necessary, the program adds a number of high padding records sufficient to complete the last block. If the user has specified that the high padding check be made, and additional padding, if necessary, be high padding, the program either: (1) completes the last block with high padding records already in the file and drops the remaining high padding records in the file; or (2) adds a sufficient number of high padding records to complete the last block. If the user has specified that all high padding records be dropped, but adds or deletes data records through a Phase 3 modification, the program may add high padding records to complete the last block.

When all of the data records have been processed, input and output data-record counts are checked, the output file is closed, and a branch is made to the end-of-program routine in the System Monitor.

## Program Modification

### General Information

Modifications to the sort program(s) should be made only after careful analysis of the user's Operating System indicates that this course of action is more economical than other ways of achieving the desired result. Among the alternative procedures that the user should investigate are providing the desired function through another program in the system, or writing a special pre-edit or post-edit program to provide the function. Some factors to be considered before modifying the sort program are:

1. Processing routines added to the sort program must, in most cases, include instructions to save and restore index registers.
2. The reservation of core storage for added programming, particularly in a system with 60,000 core-storage positions, may restrict the normal assignment of core storage data areas and thus reduce the maximum merge order for Phase 2 and/or 3. This may result in additional Phase 2 merging passes in order to complete an application.
3. Other system programs through which the function can be provided may be more readily modified; their contents may also be better known to the programmer.

However, the particular application may dictate the advisability of adding user-written modification routines to the sort program(s). To simplify the added programming required in these cases, and to facilitate the inclusion of the added routines, the generalized program provides the user with the capability of activating exit points at logical junctures in the sort program he is creating. The three phases in which exit points are available are the General Assignment Phase, Phase 1, and Phase 3. The user can activate exit points by specifying the MOD (or QMOD) parameter (i.e., the program will be modified) on the disk Sort Definition control card and providing the added programming on the SIU or System Library file. The TITLE or CALLN card for the added routines must specify the exit points to be activated.

If the MOD (or QMOD) parameter is not specified, no exit points will be activated. If the MOD (or QMOD) parameter is specified, only the exit points designated on the TITLE or CALLN cards for the added routines will be activated. All exit points not activated at Sort Definition will not exist in the created sort program.

Various fields within the sort program's Sort Common area, and fields in certain subroutines of the program itself, are available for reference by the user-written modification routines. Because all reference to these fields can be made through the use of specified linkage symbols, the need for the user's consulting program listings is eliminated. Since the programs operate in a relocatable environment and are loaded through the Linkage Loader, the modification routines need not be reassembled if a subsequent re-creation and/or relocation of the sort program becomes necessary. Once the modification routines have been satisfactorily programmed and tested, they will run properly with the phase in which they reside despite any change in the core-storage location of the phase.

Added routines, at each of the exits activated, are relocated by the Linkage Loader as open routines at the appropriate logical points in the program. Therefore, there is no problem of determining and specifying the exact location for the added programming. The added programming becomes, in effect, an integral part of the program when it is relocated and converted to absolute form.

### General Procedure

#### Inclusion of Added Programming

Each routine to be included with a sort program should normally be compiled as a separate program with an origin at 00000. If more than one routine is to be placed at the same exit point, the user, by compiling the routines as one large routine or phase, can obviate the need for including his own linkage symbols for intercommunication between the routines.

#### User's Procedures

The user's added programming must be included at Sort Definition. The Sort Definition program thus produces a sort program consisting of the appropriate IBM-supplied subroutines and user routines inserted at the appropriate points. To permit his modification routines to be included, the user must perform the following:

1. Specify the MOD (or QMOD if exit P11 is not to be used) parameter on the Sort Definition (DSORT) control card.
2. Include on the SIU the TITLE or CALLN card for the added routine; the type of card used depends on where the added routine resides.



If the added routine has been placed on the *siu*, the *TITLE* card containing the name of the added routine immediately follows the *Sort Definition (DSORT)* and *Unit Definition (DUNIT)* cards, and immediately precedes the cards containing the actual added routine. If the added routine resides on the *Go* file or in the same relocatable library as the sort subroutines, a Linkage Loader *CALLN* card, containing the name of the added routine, immediately follows the *DSORT* and *DUNIT* cards on the *siu*.

In either case, the user must indicate to the Sort Definition Program the exit point at which the material is to be added. This is done by punching the Exit Identifier code in columns 1 through 3 of the added-programming *TITLE* card or the *CALLN* card for the added routine. The Exit Identifier code is the name by which the exit is known (e.g., *CA1*, *P11*, *P32*, etc.). Any number of modifications may be added at each exit point. The material must, however, be added in the order in which the exit points appear (see Figure 7 and "Exit Point Descriptions" in this section).

The other user procedures for definition of the sort program are consistent with those described under "Program Definition."

#### Sort Definition Program Operation — Modified Program

The presence of the *MOD* (or *QMOD*) parameter on the *DSORT* card indicates to the Sort Definition Program that it must look for the first added programming card on the *siu*. From this card, the Sort Definition Program determines where the material is to be added. As the program generates the Linkage Loader input statements, it checks each exit point until the one specified is reached. If the first added programming card is a *TITLE* card, the Sort Definition Program copies the added programming from the *siu* onto symbolic unit *MW2*; this will continue until the next *TITLE* or *CALLN* card is recognized, a *DSORT* or *DUNIT* card is reached, or an end of file is signalled by the System Monitor. If the first added programming card is a *CALLN* card, the *CALLN* statement will be placed on *MW2*.

Each subsequent modification or *CALLN* statement for a modification will be placed in the proper sort-program location on symbolic unit *MW2*. If a user-written modification routine is included out-of-sequence on the *siu* (e.g., a routine to be inserted at exit point *P13* is placed after a routine to be included at exit point *P32*), that modification (*P13* in this example) and all modifications subsequent to it may be excluded from the sort program.

When the file produced on *MW2* is processed by the Linkage Loader, the added programming is included

as an integral part of the absolute program. All linkage symbol references between user-written modification routines and the sort program subroutines will be resolved.

#### Example—Defining and Executing a Modified Sort Program

Assume that the user desires to add two routines after the control card reading routine in the General Assignment Phase; the exit at this point is *GA2*. The routines have already been compiled and are in relocatable form on the *siu*. Assume also that a user-written modification routine has been compiled by a preceding Autocoder run and is located on the *Go* file. This modification is to be placed at exit point *P33*, before the sort end-of-program routine. The cards shown in Figure 8 would be used in the *siu*.

Col 1	6	16	21
	MON\$\$	EXEQ	DSRTDEFINE
	SORTNAME	DSORT	MOD
		DUNIT	MR1,MR2,MR3,MR4
GA2		TITLE	ASSGNMOD1
		.	
		(relocatable deck)	
		.	
GA2		TITLE	ASSGNMOD2
		.	
		(relocatable deck)	
		.	
P33	MON\$\$	CALLN	EOFMOD
		EXEQ	LINKLOAD
		INPUT	MW2
	MON\$\$	EXEQ	SORTNAME
		etc.	

Figure 8. Example — Control Cards for Producing a Modified Sort Program

#### Execution of Added Programming

With the exception of user-written routines at the first exit point (*CA1*), added programming is executed as in-line coding. The instructions preceding will "fall through" to the modification, which in turn may "fall through" to the instructions following. The need for entry and exit branches is therefore eliminated. For some exit points, additional return points are provided through certain linkage symbols. These are specified in the descriptions of the individual exit points. Figure 9 summarizes the locations and suggested uses of the various exit points. Detailed explanations of each exit point can be found in the "Exit Point Descriptions" section.

Summary of Exit Points	
Exit Point	Description
CA1	If activated, is located immediately above the Sort Common area throughout the execution of the sort. Has no entry from the program. Can be used for constants and routines shared by other exit points. For example, IOCS exit routines would most likely be placed in this area.
GA1	If activated, exists as part of the General Assignment Phase. Occurs after initialization of the Sort Common and prior to execution of the control card reading routine. Entered once during the program. Suggested function of user-written routines: modifying or supplying control information.
GA2	If activated, exists as part of the General Assignment Phase. Occurs after the reading of control cards and setting up of the Sort Common, and prior to the checking of the control information for validity and consistency. Entered once during the program. Suggested function of user-written routines: modifying or supplying control information.
GA3	If activated, exists as part of the General Assignment Phase. Occurs after the completion of the General Assignment Phase and just prior to the linking to Phase 1 of the sort program. Entered once during the program. Suggested type of user-written routines: user's assignment routines.
P11	If activated, exists as part of Phase 1 throughout the execution of the phase. Occurs at the point in the running program where each input record is to be moved to the Record Storage Area from the input area. Entered for each input record. Suggested functions of user-written routines: performing record addition, deletion, or modification.
P12	If activated, exists as part of Phase 1 during the assignment program only. Occurs prior to the execution of any of the Phase 1 assignment routines. Entered once during the program. Suggested type of user-written routines: user's assignment routines.
P13	If activated, exists as part of Phase 1 during the assignment program only. Occurs at the point of setting up the File Table

Summary of Exit Points	
Exit Point	Description
P13 (cont.)	and IORW's for the output file. Entered once during the program. Suggested function of user-written routines: modification of File Tables, and IORW's for the output file.
P14	If activated, exists as part of Phase 1 during the assignment program only. Occurs at the point of the setting up of the File Tables and IORW's for the input files. Entered once during the program. Suggested functions of user-written routines: modification of File Tables, File Table Extensions, and IORW's for the input file.
P31	If activated, exists as part of Phase 3 throughout execution of the phase. Occurs at the point in the running program where each record leaves the merge network. Entered once per record (except for the first record). Suggested function of user-written routines: summarization of records.
P32	If activated, exists as part of Phase 3 throughout the execution of the phase. Occurs prior to the moving of each data record to the output area. Entered once per output record. Suggested functions of user-written routines: addition, deletion, or modification of records.
P33	If activated, exists as part of Phase 3 throughout the execution of the phase. Occurs at the end of the program, just prior to linking to the System Monitor to execute the next program. Entered once during the program. Suggested type of user-written routines: user end-of-program routines.
P34	If activated, exists as part of Phase 3 during the assignment program only. Occurs prior to the execution of any of the Phase 3 assignment routines. Entered once during the program. Suggested type of user-written routines: assignment routines.
P35	If activated, exists as part of Phase 3 during the assignment program only. Occurs when the File Table and IORW for the final output file are set up. Entered once. Suggested function for user-written routines: modification of the File Table, Table Extension, and IORW for the output file.

NOTE: The location of the exit points is illustrated in the memory map shown in Figure 7, in the "Program Description" section.

Figure 9. Summary of Exit Points

## Information on Implementation

### Storage Requirements

To determine the amount of core storage available for added programming, the user must consider the following factors:

1. Amount of core storage needed for the Resident Monitor and the IOCS.
2. Amount of core storage needed for the Telc-processing Supervisor, if present.
3. Amount of core storage needed for user-written routines utilized in conjunction with items 1 and 2 above.
4. Amount of core storage needed for the sort program and for record storage.

The size of the first three factors must be determined by the user for his particular system. The approximate core-storage requirements for the various phases of a sort program are shown in Figure 10. By figuring out the total system core-storage requirements (including record storage) for a particular phase, and subtracting this sum from the total amount of core

storage available in the computer system, the user can determine the approximate amount of core storage available for added programming in that phase. By performing this calculation for the remaining phases, the user can determine the amount of core storage available for added routines in each phase of the program.

### Types of Modification Routines

The user may include at each exit point the type(s) of modification routines desired. However, certain exit points, if activated, will occur at locations in the program especially conducive to the performance of a particular type of function. Figure 9 indicates suggested uses for each exit point.

The types of user-written modification routines associated most closely with specific exit points are control information, record modification, and input-output routines. The "Sort Common Area" section describes in detail the Sort Control Information Area in sort common, and contains considerations for user-modification or establishment of this area. The descriptions of exit points P11, P31, and P32 in "Exit Point

Phase or Subphase	Exit Points in Core Storage	Amount of Core Storage Required
General Assignment	CA1,GA1,GA2,GA3	12,400 positions
Phase 1 Assignment	CA1,P11,P12,P13,P14	17,300 positions
Phase 1 Running Program	CA1,P11	13,200 + IRL positions
Phase 2 Assignment	CA1	16,300 positions
Phase 2 Running Program	CA1	15,400 + M(2,850) positions
Phase 3 Assignment	CA1,P31,P32,P33,P34,P35	13,600 positions
Phase 3 Running Program	CA1, P31,P32,P33	9,100 + M(2,850) + 2ORL positions
IRL = Input tape or disk record length M = Merge order ORL = Output tape or disk record length  NOTE: The above requirements allow for a minimum sort only, with a sort blocking factor (B) of 1, an internal sort size (G) of one record, and a single control data field. Approximately 400 additional positions will be required in each of Phases 1, 2, and 3 if multiple control data fields are specified.		

Figure 10. Sort Program Core-Storage Requirements

Descriptions" outline the steps that a user's routine must perform if records are to be modified on input and/or output.

#### Input/Output Modification

The user can, through the sort program, have access to the iocs File Tables, File Table Extensions, and iorw's (Input/Output Request Words); he thus has the capability of activating the iocs error, tape-label, service, and end-of-file routines.

At exit point P14, the user may either alter the contents of the input File Table, File Table Extension, and /or iorw, or completely replace the tables and request word provided by the program with ones contained in his own added programming. At exit points P13 or P35, the user may do the same for the output File Table, File Table Extension, and/or iorw. However, only certain fields within these tables are completely available to the user; the sort program requires specific values in many of the fields to complete its execution.

The publication *Basic Input/Output Control System*, Form C28-0322, contains a full description of the arrangement and contents of the File Tables, File Table Extensions, and iorw's. The following discussion assumes that the reader has an understanding of the information contained therein.

The user has access to the iocs File Tables, File Table Extensions, and iorw's because he has access to

the Sort Common area. The sort program uses areas in Sort Common for setting up the tables that are actually utilized by the iocs during the running program. These tables are set up during the assignment programs; the File Tables and iorw's set up are then moved to their respective working areas. Since only two File Table Extensions are produced (one for input, the other for output), the iocs refers directly to these areas in the Sort Common location. If tape-labels are not used, no reference is made to the File Table Extension.

By modifying the appropriate fields in Sort Common, the user can, in effect, modify related File Table and iorw fields used throughout the program. In addition to the two File Table Extensions, there is one File Table area and one iorw area in Sort Common. The File Table and iorw areas are used to set up the input, merge, and output iocs File Tables and iorw's for each phase of the program.

The following assumptions and requirements apply to the File Tables, File Table Extensions, and iorw's, as set up by the program.

1. They are initially set for no labels. This condition may be altered by LABELDES control card entries.
2. They are initially set for Move mode, even parity. The parity may be altered by control card entries.
3. Checking of all error conditions will be specified (except for WLR which is set during the running program to check for wrong-length records on fixed-length tape records only).
4. All uncorrectable errors will be accepted. This condition may be altered by control card information to skip uncorrectable errors during Phase 1 input only.
5. The rewind option RRUV is assumed for Phase 1 input and Phase 3 output. This condition may be changed by control card information.
6. The end-of-file address is set to the sort program end-of-file routine. If the address is changed to a user address, the user's routine must save the sort program address for the return to the running program. This applies to Phase 1 only.
7. The File Tables and File Table Extensions are set for Form 1 records and must not be changed. Any other entry will prevent proper execution of the program.

The contents of the fields contained in the File Table, File Table Extension, and iorw areas are described in the "Sort Common Area" subsection. These descriptions also indicate whether or not a field may be changed by the user.

#### Index Register Conventions

In all cases, the user must adhere to basic index register conventions established for the Operating System. These are described in detail in the *System Monitor*



Sort Comman Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Comman
Field 1	COMSRTTYPE	DCW	3	Alphameric	1-3
Field 2	COMIOUNIT1	DCW	5	Numerical	4-8
Field 3	COMIOUNIT2	DCW	5	Numerical	9-13
Field 4	COMIOUNIT3	DCW	5	Numerical	14-18
Field 5	COMIOUNIT4	DCW	5	Numerical	19-23
Field 6		DCW	1	Alphameric	24
		DCW	1	Numerical	25
		DCW	1	Numerical	26
		DCW	6	Numerical	27-32
Field 7	COMAWORKAR	DCW	4	Numerical	33-36
		DCW	1	Alphameric	37
		DCW	1	Numerical	38
		DCW	1	Numerical	39
		DCW	6	Numerical	40-45
	COMBWORKAR	DCW	4	Numerical	46-49
Field 8	COMRECLNTH	DCW	4	Numerical	50-53
Field 9	COMIPRECLN	DCW	4	Numerical	54-57
Field 10	COMOPRECLN	DCW	4	Numerical	58-61
Field 11	COMINPTBLK	DCW	4	Numerical	62-65
Field 12	COMINPTLEN	DCW	4	Alphameric	66-69
Field 13	COMOTPTBLK	DCW	4	Numerical	70-73
Field 14	COMOTPTLEN	DCW	4	Numerical	74-77
Field 15	COMBLKFCTR	DCW	3	Numerical	78-80
Field 16	COMSORTLEN	DCW	4	Numerical	81-84
Field 17	COMRECFORM	DCW	1	Numerical	85
Field 18	COMCTFLDN	DCW	1	Numerical	86
Field 19	COMCTLSIZE	DCW	4	Numerical	87-90
Field 20	COMCTLLOC1	DCW	4	Numerical	91-94
Field 21	COMCTLSIZ1	DCW	3	Numerical	95-97
Field 22	COMCTLLOC2	DCW	4	Numerical	98-101
Field 23	COMCTLSIZ2	DCW	3	Numerical	102-104
Field 24	COMCTLLOC3	DCW	4	Numerical	105-108
Field 25	COMCTLSIZ3	DCW	3	Numerical	109-111
Field 26	COMCTLLOC4	DCW	4	Numerical	112-115
Field 27	COMCTLSIZ4	DCW	3	Numerical	116-118
Field 28	COMCTLLOC5	DCW	4	Numerical	119-122
Field 29	COMCTLSIZ5	DCW	3	Numerical	123-125
Field 30	COMCTLLOC6	DCW	4	Numerical	126-129
Field 31	COMCTLSIZ6	DCW	3	Numerical	130-132
Field 32	COMCTLLOC7	DCW	4	Numerical	133-136
Field 33	COMCTLSIZ7	DCW	3	Numerical	137-139
Field 34	COMCTLLOC8	DCW	4	Numerical	140-143
Field 35	COMCTLSIZ8	DCW	3	Numerical	144-146
Field 36	COMCTLLOC9	DCW	4	Numerical	147-150
Field 37	COMCTLSIZ9	DCW	3	Numerical	151-153
Field 38	COMCTLLOC0	DCW	4	Numerical	154-157
Field 39	COMCTLSIZ0	DCW	3	Numerical	158-160
Field 40	COMFILESIZ	DCW	7	Numerical	161-167
Field 41	COMMODSPH1	DCW	5	Numerical	168-172
Field 42	COMMODSPH2	DCW	5	Numerical	173-177
Field 43	COMMODSPH3	DCW	5	Numerical	178-182
Field 44	COMRCDSPR0	DCW	7	Numerical	183-189
Field 45	COMPADDING	DCW	1	Numerical	190
Field 46	COMIMODPAR	DCW	1	Alphabetic	191
Field 47	COMOMODPAR	DCW	1	Alphabetic	192
Field 48	COMREELCNT	DCW	2	Numerical	193-194
Field 49	COMLABELOP	DCW	1	Numerical	195
Field 50	COMRCCSIZE	DCW	1	Numerical	196
Field 51	COMRCCLOCA	DCW	4	Numerical	197-200
Field 52	COMINBLKCT	DCW	5	Numerical	201-205
Field 53	COMDSKRDMD	DCW	1	Numerical	206
Field 54	COMASCSORT	DCW	1	Alphabetic	207
Field 55	COMCHECKPT	DCW	1	Alphabetic	208
Field 56	COMOPRWDRU	DCW	4	Alphabetic	209-212
Field 57	COMMODASEQ	DCW	4	Numerical	213-216
Field 58	COMMODBSEQ	DCW	4	Numerical	217-220
Field 59	COMPH2MAXM	DCW	2	Alphabetic	221-222
Field 60	COMPH3MAXM	DCW	2	Alphabetic	223-224
Field 61	COMSTRNTKS	DCW	4	Numerical	225-228

Figure 11. Sort Common Field Description Chart, Fields 1 through 61 (Sort Control Information Area)

program can determine which physical unit(s) contains the input file. The address constant is developed and used as follows: the Linkage Loader converts the user's input file symbolic unit designation to this address constant (the symbolic unit designation is used in that form throughout the program); prior to the input file being opened, the sort program places the address constant in the symbolic unit field of the File Table model (see Sort Common Fields 116 through 145). For information on the function and designation of the input file, see "Unit Definition Card" in the "Program Definition" section.

*Field 3:* Set up by a Linkage Loader load card produced by the Sort Definition Program. This field contains an address constant through which the sort program can determine which physical unit(s) contains the output file. The address constant is developed and used as follows: the Linkage Loader converts the user's output file symbolic unit designation to this address constant (the symbolic unit designation is used in that form throughout the program); prior to the output file's being opened, the sort program places the address constant in the symbolic unit field of the File Table model (see Sort Common Fields 116 through 145). For information on the function and designation of the output file, see "Unit Definition Card" in the "Program Definition" section.

*Field 4:* Set up by a Linkage Loader load card produced by the Sort Definition Program. This field contains an address constant through which the sort program can determine the physical unit(s) that constitutes the first work area, work area A. The address constant is developed as follows: the Linkage Loader converts the user's work area A symbolic unit designation to this address constant (the symbolic unit designation is used in that form throughout the program); prior to work file A's being opened, the sort program places the address constant in the symbolic unit field of the File Table model (see Sort Common Fields 116 through 145). However, if the number of tracks assigned to work area A is less than the number assigned to work area B, the sort program will switch Fields 4 and 5 before moving the address constant for either field to the File Table area. For information on the function and designation of work area A, see "Unit Definition Card" in the "Program Definition" section.

*Field 5:* Set up by a Linkage Loader load card produced by the Sort Definition Program. This field contains an address constant through which the sort program can determine the physical unit(s) that constitutes the second work area, work area B. The address constant is developed as follows: the Linkage Loader converts the user's work area B symbolic unit designation to this address constant (the symbolic unit designation is used in that form throughout the pro-

gram); prior to work file B's being opened, the sort program places the address constant in the symbolic unit field of the File Table model (see Sort Common Fields 116 through 145). However, if the number of tracks assigned to work area B is greater than the number assigned to work area A, the sort program will switch Fields 4 and 5 (see above). For information on the function and designation of work area B, see "Unit Definition Card" in the "Program Definition" section.

*Field 6:* The common area checking routine places the actual disk address of work area A in this field. Before execution of the routine, the channel (high-order position in the field) is set to "@." The remaining positions in the field are initially zeros. Word marks are set in positions 1, 2, 3, 4, and 10.

*Field 7:* The common area checking routine places the actual disk address of work area B in this field. Initial contents of the field are as follows: the channel (high-order position in the field) is an "@;" the module position contains a 1; and the remaining positions in the field contain zeros. Word marks are set in positions 1, 2, 3, 4, and 10.

*Field 8:* Initially set to zeros. The parameter value specified for RECLN (see "SORTTYPE Parameters" in the "Program Operation" section) is placed here. This field thus contains the data-record length used throughout the sort program for fixed-length records, or the maximum data-record length used throughout the program for variable-length records. If the input to the sort is unblocked without a record mark, and the output is to be unblocked without a record mark, Field 8 is incremented by one by the common area checking routine.

*Field 9:* Initially set to zeros. It takes its information from the INPUTFILE parameter LENMODREC, if that parameter has been specified. Thus, if the data-record length for input is to be altered by a user-written modification routine in Phase 1, the input data-record length after the change is placed in this field. If the input consists of unblocked records without a record mark, and the output is to be either blocked or unblocked with a record mark, the input data-record length (i.e., without the record mark) is placed in this field. If the input data-record length is unspecified (i.e., the input LENMODREC parameter has not been included by the user), the sort program will assume that the input data-record length is the same as the data-record length specified in the RECLN parameter on the SORTTYPE control card; the common area checking routine thus places in Field 9 the same value contained in Field 8.

*Field 10:* Initially set to zeros. It takes its information from the OUTPUTFILE parameter LENMODREC, if that parameter has been specified. Thus, if the data-record

length for output is to be altered by a user-written modification routine in Phase 3, the output data-record length after the change is placed in this field. If the output is to consist of unblocked records without a record mark, and the input consists of either blocked records or unblocked records with a record mark, the output data-record length (i.e., without the record mark) is placed in this field. If the output data-record length is unspecified (i.e., the output LENMODREC parameter has not been included by the user), the sort program will assume that the output data-record length is the same as the data-record length specified in the RECLen parameter on the SORTTYPE control card; the common area checking routine thus places in Field 10 the same value contained in Field 8.

*Field 11:* Initially set to 0001. If the input consists of blocked, fixed-length records (Form 2), this field contains the number of records per input block. If the input consists of unblocked fixed or variable-length records (Form 1) without record marks, this field contains 0000. If the input consists of unblocked fixed or variable-length records (Form 1) with record marks, this field contains 0001. For blocked, variable-length input (Form 4), this field is initialized to 0002 by the common area checking routine; this signifies to the program that the output is to be blocked.

*Field 12:* Initially set to zeros. If the input consists of blocked, variable-length records (Form 4), this field contains the maximum input block length. If the input consists of blocked fixed-length records (Form 2), the common area checking routine computes the input block length and places the figure in this field. If the input consists of unblocked, fixed- or variable-length records (Form 1), this field will contain the same value as Field 9.

*Field 13:* Initially set to 0001. If the output is to consist of blocked, fixed-length records (Form 2), this field contains the number of records per output block. If the output is to consist of unblocked fixed- or variable-length records (Form 1), without record marks, this field contains 0000. If the output is to consist of unblocked fixed- or variable-length records (Form 1) with record marks, this field contains 0001. For variable-length blocked output (Form 4), this field is initialized to 0002 by the common area checking routine.

*Field 14:* Initially set to zeros. If the output is to consist of blocked, variable-length records (Form 4), this field contains the maximum output block length. If the output is to consist of blocked, fixed-length records (Form 2), the common area checking routine computes the output block length and places the figure in this field. If the output is to consist of unblocked, fixed- or variable-length records (Form 1), this field will contain the same value as Field 10.

*Field 15:* Initially set to zeros. The Phase 1 assignment program computes the number of sort records per track and places the result in this field. (If variable-length records are used, each record is treated by the sort as having a length equal to that of the maximum data-record length specified.)

*Field 16:* Initially set to zeros. The Phase 1 assignment routine multiplies the sort data record length by the sort blocking factor and places the result in this field.

*Field 17:* Initially set to zero. The control card reading routine in the General Assignment Phase places the output record format value in this field; the user may enter the value himself via a modification routine at exit point GA1 or GA2, prior to the execution of the common area checking routine.

*Field 18:* Initially set to 1. The control card reading routine places in this field the number of control data fields in the record; this will be the actual number except when there are ten fields. In the last case, a zero will be placed in the field. The user may enter the value for this field via a modification routine at exit point GA1 or GA2, prior to the execution of the common area checking routine.

*Field 19:* Initially set to zeros. The control card reading routine places the size of the control data word in this field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 20:* Initially set to zeros. The control card reading routine places in this field the relative location of the major control data field in the record. User alternative procedures, as described under "Field 18," apply for this field.

*Field 21:* Initially set to zeros. The control card reading routine places in this field the size of the major control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 22:* Initially set to zeros. The control card reading routine places in this field the relative location of the second control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 23:* Initially set to zeros. The control card reading routine places in this field the size of the second control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 24:* Initially set to zeros. The control card reading routine places in this field the relative location of the third control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 25:* Initially set to zeros. The control card reading routine places in this field the size of the third



control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 26:* Initially set to zeros. The control card reading routine places in this field the relative location of the fourth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 27:* Initially set to zeros. The control card reading routine places in this field the size of the fourth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 28:* Initially set to zeros. The control card reading routine places in this field the relative location of the fifth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 29:* Initially set to zeros. The control card reading routine places in this field the size of the fifth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 30:* Initially set to zeros. The control card reading routine places in this field the relative location of the sixth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 31:* Initially set to zeros. The control card reading routine places in this field the size of the sixth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 32:* Initially set to zeros. The control card reading routine places in this field the relative location of the seventh control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 33:* Initially set to zeros. The control card reading routine places in this field the size of the seventh control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 34:* Initially set to zeros. The control card reading routine places in this field the relative location of the eighth control data field. User procedures, as described under "Field 18," apply to this field.

*Field 35:* Initially set to zeros. The control card reading routine places in this field the size of the eighth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 36:* Initially set to zeros. The control card reading routine places in this field the relative location of the ninth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 37:* Initially set to zeros. The control card reading routine places in this field the size of the ninth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 38:* Initially set to zeros. The control card reading routine places in this field the relative location of

the tenth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 39:* Initially set to zeros. The control card reading routine places in this field the size of the tenth control data field. User alternative procedures, as described under "Field 18," apply to this field.

*Field 40:* Initially set to zeros. The control card reading routine places in this field the user's specified file size. The user may enter the value for this field via a modification routine at exit point GA1 or GA2, prior to the execution of the common area checking routine. The field is used in Phase 1 to check whether or not the number of records specified by the user will exceed sort capacity (the number of records that can be accommodated in accordance with the amount of disk work space allotted).

*Field 41:* Initially set to zeros. If the information is provided, the control card reading routine places in this field the amount of core storage required for added programming in Phase 1. The user may enter the value for this field via a modification routine at exit point GA1 or GA2, prior to the execution of the common area checking routine.

*Field 42:* Initially set to zeros. If the information is provided, the control card reading routine places in this field the amount of core storage required for added programming in Phase 2. User alternative procedures, as described under "Field 41," apply to this field.

*Field 43:* Initially set to zeros. If the information is provided the control card reading routine places in this field the amount of core storage required for added programming in Phase 3. User alternative procedures, as described under "Field 41," apply to this field.

*Field 44:* This field is for the internal use of the sort. It contains the number of records that have been written upon completion of Phase 1, and subsequently the number written by each pass of Phase 2.

*Field 45:* Initially an A. If the information is provided, the control card reading routine places in this field a character indicating the padding option specified by the user. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3. The A option indicates there will be no padding checks and, if necessary, high padding will be added.

*Field 46:* Initially a U. If the information is provided, the control card reading routine places in this field a character indicating the input parity. The user may enter the value for this field via a modification routine at exit point GA1 or GA2. The letter U indicates even parity. The other option is represented by a B, indicating odd parity.

*Field 47:* Initially a U. If the information is provided, the control card reading routine places in this field a character indicating the output parity. The characters



representing each option and the user's alternative procedures are the same as described in "Field 46."

*Field 48:* Initially set to 01. If the information is provided, the control card reading routine places in this field the number of reels that make up the sort input file. This field is used by the sort only if the input file is on tape. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3.

*Field 49:* Initially set to zero. If the information is provided, the control card reading routine places in this field a number indicating the type of tape labels used. This field is used by the sort only if the input and/or output is on magnetic tape. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3. If tape labels are used, the field should contain the following: a 1 if IBM 1410 80-character labels are used; a 2 if IBM Standard 120-character labels are used; and a 3 if nonstandard labels are used.

*Field 50:* Initially set to zero. If the information is provided, the control card reading routine places in this field the size of the Record Character-Count field. This field is used by the sort only for variable-length records, and is necessary only for blocked, variable-length records (Form 4). The user may enter the value for this field via a modification routine at exit point GA1 or GA2.

*Field 51:* Initially set to zero. If the information is provided, the control card reading routine places in this field the relative location, within each record, of the Record Character-Count field. Use of this field by the sort, and user alternative procedures for entering the value, is the same as described in "Field 50."

*Field 52:* Initially set to zero. If the information is provided, the control card reading routine places in this field the number of disk records in the input file; the user may have specified either the number itself or the letters IPI. In the latter case, the sort program will obtain the number, determined by a previous program, from the Resident Monitor /IPI/ field. The user may enter the value for this field via a modification routine at exit point GA1 or GA2.

*Field 53:* Initially set to 1. If the information is provided, the control card reading routine places in this field the iocs disk file option to be used for reading the input file and/or writing the output file. This field is used by the sort only if the input and/or output file is on disk. The user may enter the value for this field via a modification routine at exit point GA1 or GA2. The 1 will result in the iocs routines for Form A disk files being used. The field should contain a 2 for Form G disk files, and a 3 for Form C disk files.

*Field 54:* Initially an A. If the information is provided, the control card reading routine places in this field the character specifying whether the sort is ascend-

ing or descending. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3. The character A signifies that the sort will be ascending. If the sort will be descending, this field should contain the letter D.

*Field 55:* Initially an N. If the information is provided, the control card reading routine places in this field a character indicating whether or not checkpoints should be taken. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3. If checkpoints are not to be taken, this field should contain an N. If checkpoints are to be taken, this field should contain a Y.

*Field 56:* Initially RRUU. If the information is provided, the control card reading routine places in this field the characters specifying the output file rewind option. The user may enter the value for this field via a modification routine at exit point GA1, GA2, or GA3. The sort will use this field only if the output file is to be on tape. Each of the four characters in the field represent one of the three iocs rewind options; these are R (rewind), U (rewind and unload), and N (take no action). Information on the input file rewind options is moved directly into the File Table area (see Field 119). For a further explanation of the rewind options, see REWIND, under INPUTFILE parameters in the "Program Operation" section.

*Field 57:* Initially set to zeros. This field is for the internal use of the sort. At the end of Phases 1 and 2, it contains the number of sequences written on disk work area A.

*Field 58:* Initially set to zeros. This field is for the internal use of the sort. At the end of Phase 1 and 2, this field contains the number of sequences written on disk work area B.

*Field 59:* Initially set to zeros. This field is for the internal use of the sort. It contains the maximum possible merge order for Phase 2, as determined in the Phase 1 assignment program. The field is always signed plus.

*Field 60:* Initially set to zeros. This field is for the internal use of the sort. It contains the maximum possible merge order for Phase 3, as determined in the Phase 1 assignment program. The field is always signed plus.

*Field 61:* Initially set to zeros. This field is for the internal use of the sort. It contains the number of disk tracks per sort sequence.

The following areas in Sort Common provide the structure for creating the File Tables, File Table Extensions, and iorw's utilized by the sort program. The File Tables and iorw's created in the respective Sort Common areas are moved by the iocs to other core storage areas for reference during the sort program.

The areas and the fields that they contain are as follows:

1. Sort input File Table Extension area (Sort Common Fields 62 through 81)
2. Sort output File Table Extension area (Sort Common Fields 82 through 101)
3. Basic IORW area (Sort Common Fields 102 through 115)
4. Basic File Table area (Sort Common Fields 116 through 144)

The last field in the Sort Common area (Field 145) contains a group mark with word mark.

Each of the above File Table Extension areas has sufficient fields to enable the specification of up to four exit addresses for user-written tape-label routines.

The following description of the fields is related to their use with and by the sort program. The definitive description of the contents and use of the areas is contained in the publication *Basic Input/Output Control System*.

#### Sort Input File Table Extension Area

(Additional information on each field in this area is provided in Figure 12.)

**Field 62:** Initially a blank. This field contains the terminating table lookup character.

**Field 63:** Initially five blanks. This field contains the first tape-label routine address.

**Field 64:** Initially blank. This field contains the first tape-label exit indicator.

**Field 65:** Initially five blanks. This field contains the second tape-label routine address.

**Field 66:** Initially blank. This field contains the second tape-label exit indicator.

**Field 67:** Initially five blanks. This field contains the third tape-label routine address.

**Field 68:** Initially blank. This field contains the third tape-label exit indicator.

**Field 69:** Initially five blanks. This field contains the fourth tape-label routine address.

**Field 70:** Initially blank. This field contains the fourth tape-label exit indicator.

**Field 71:** Initially a W. This field contains the first tape-label indicator.

**Field 72:** Initially a V. This field contains the second tape-label indicator.

**Field 73:** Initially a V. This field contains the third tape-label indicator.

**Field 74:** Initially a V. This field contains the fourth tape-label indicator.

**Field 75:** Initially a V. This field contains the fifth tape-label indicator.

**Field 76:** Initially blank. The control card reading routine places the designation of the input record form in this field. The field should contain F, W, or X for Form 1, 2, or 4 input records, respectively. The user can enter the value for this field via a modification routine.

**Field 77:** Initially blank. This field contains the retention period.

**Field 78:** Initially blank. This field contains the creation date.

**Field 79:** Initially blank. This field contains the file identifier.

**Field 80:** Initially blank. This field contains the file serial number.

**Field 81:** Initially blank. This field contains the reel serial number.

Sort Common Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Common
Field 62	COMINPEXTN	DCW	1	Alphameric	229
Field 63	COMIPEXT01	DCW	5	Numerical	230-234
Field 64	COMIPEXT02	DC	2	Alphameric	235-236
Field 65	COMIPEXT03	DCW	5	Numerical	237-241
Field 66	COMIPEXT04	DC	2	Alphameric	242-243
Field 67	COMIPEXT05	DCW	5	Numerical	244-248
Field 68	COMIPEXT06	DC	2	Alphameric	249-250
Field 69	COMIPEXT07	DCW	5	Numerical	251-255
Field 70	COMIPEXT08	DC	2	Alphameric	256-257
Field 71	COMIPEXT09	DC	1	Alphabetic	258
Field 72	COMIPEXT10	DC	1	Alphabetic	259
Field 73	COMIPEXT11	DC	1	Alphabetic	260
Field 74	COMIPEXT12	DC	1	Alphabetic	261
Field 75	COMIPEXT13	DC	1	Alphabetic	262
Field 76	COMIPEXT14	DCW	1	Alphabetic	263
Field 77	COMIPEXT15	DCW	4	Numerical	264-267
Field 78	COMIPEXT16	DCW	5	Numerical	268-272
Field 79	COMIPEXT17	DCW	10	Alphameric	273-282
Field 80	COMIPEXT18	DCW	5	Alphameric	283-287
Field 81	COMIPEXT19	DCW	4	Numerical	288-291

Figure 12. Sort Common Field Description Chart, Fields 62 through 81 (Sort Input File Table Extension Area)

Sort Common Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Common
Field 82	COMOTPEXTN	DCW	1	Alphameric	292
Field 83	COMOPEXT01	DCW	5	Numerical	293-297
Field 84	COMOPEXT02	DC	2	Alphameric	298-299
Field 85	COMOPEXT03	DCW	5	Numerical	300-304
Field 86	COMOPEXT04	DC	2	Alphameric	305-306
Field 87	COMOPEXT05	DCW	5	Numerical	307-311
Field 88	COMOPEXT06	DC	2	Alphameric	312-313
Field 89	COMOPEXT07	DCW	5	Numerical	314-318
Field 90	COMOPEXT08	DC	2	Alphameric	319-320
Field 91	COMOPEXT09	DC	1	Alphabetic	321
Field 92	COMOPEXT10	DC	1	Alphabetic	322
Field 93	COMOPEXT11	DC	1	Alphabetic	323
Field 94	COMOPEXT12	DC	1	Alphabetic	324
Field 95	COMOPEXT13	DC	1	Alphabetic	325
Field 96	COMOPEXT14	DCW	1	Alphabetic	326
Field 97	COMOPEXT15	DCW	4	Numerical	327-330
Field 98	COMOPEXT16	DCW	5	Numerical	331-335
Field 99	COMOPEXT17	DCW	10	Alphameric	336-345
Field 100	COMOPEXT18	DCW	5	Alphameric	346-350
Field 101	COMOPEXT19	DCW	4	Numerical	351-354

Figure 13. Sort Common Field Description Chart, Fields 82 through 101 (Sort Output File Table Extension Area)

#### Sort Output File Table Extension Area

(Additional information on each field in this area is contained in Figure 13.)

**Field 82:** Initially blank. This field contains the terminating table lookup character.

**Field 83:** Initially five blanks. This field contains the first tape-label routine address.

**Field 84:** Initially blank. This field contains the first tape-label exit indicator.

**Field 85:** Initially five blanks. This field contains the second tape-label routine address.

**Field 86:** Initially blank. This field contains the second tape-label exit indicator.

**Field 87:** Initially five blanks. This field contains the third tape-label routine address.

**Field 88:** Initially blank. This field contains the third tape-label exit indicator.

**Field 89:** Initially five blanks. This field contains the fourth tape-label routine address.

**Field 90:** Initially blank. This field contains the fourth tape-label exit indicator.

**Field 91:** Initially a W. This field contains the first tape-label indicator.

**Field 92:** Initially a V. This field contains the second tape-label indicator.

**Field 93:** Initially a V. This field contains the third tape-label indicator.

**Field 94:** Initially a V. This field contains the fourth tape-label indicator.

**Field 95:** Initially a V. This field contains the fifth tape-label indicator.

**Field 96:** Initially blank. If the output form number has not been specified, the common area checking rou-

tine places the record form specified for input in this field. If the output form number is specified, that number is placed in this field. The user may enter the value for this field via a modification routine at exit point GA1 or GA2.

**Field 97:** Initially four blanks. This field contains the retention period.

**Field 98:** Initially five blanks. This field contains the creation date.

**Field 99:** Initially ten blanks. This field contains the field identifier.

**Field 100:** Initially five blanks. This field contains the file serial number.

**Field 101:** Initially four blanks. This field contains the reel serial number.

#### Basic IORW (Input/Output Request Word) Area

(Additional information on each field in this area is contained in Figure 14.)

**Field 102:** Initially set to zeros. This is the high-order position of the link field (see *Basic Input/Output Control System*) of the iorw. The link field is made up of Sort Common Fields 102 and 103.

**Field 103:** Initially set to zeros. This is the remaining portion of the link field.

**Field 104:** Initially five blanks. This field contains the file list address (see *Basic Input/Output Control System*).

**Field 105:** Initially M@F200000R. This field contains the input/output instruction for the specific operation. If the field is modified, the parity must be consistent with the characters entered in Fields 46 and 47.

Sort Common Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Common
Field 102	COMIOSTART	DCW	1	Numerical	355
Field 103	COMIOLINKS	DC	4	Numerical	356-359
Field 104	COMFILEADR	DCW	5	Numerical	360-364
Field 105	COMOPERFLD	DCW	10	Alphameric	365-374
Field 106	COMERROCNT	DCW	2	Alphameric	375-376
Field 107	COMCHANSTA	DC	1	Alphameric	377
Field 108	COMERROINI	DC	1	Alphabetic	378
Field 109	COMERRORQ1	DC	1	Alphabetic	379
Field 110	COMERRORQ2	DC	1	Alphabetic	380
Field 111	COMERRORQ3	DC	1	Alphabetic	381
Field 112	COMERRORQ4	DC	1	Alphabetic	382
Field 113	COMERRORQ5	DC	1	Alphabetic	383
Field 114	COMERRORQ6	DC	1	Alphabetic	384
Field 115	COMSTORREG	DCW	5	Numerical	385-389

Figure 14. Sort Common Field Description Chart, Fields 102 through 115 (Basic Input/Output Request Word Area)

*Field 106:* Initially two blanks. This field contains the error count.

*Field 107:* Initially blank. This field contains an error indicator.

*Field 108:* Initially a segment mark (#). This field contains the Channel Status Character, and is used by the rocs in performing the error test.

*Field 109:* Initially a V. This is iorw indicator field Q1. (See *Basic Input/Output Control System*.)

*Field 110:* Initially a V. This is iorw indicator field Q2.

*Field 111:* Initially a V. This is iorw indicator field Q3.

*Field 112:* Initially a V. This is iorw indicator field Q4. This field must not be changed.

*Field 113:* Initially a V. This is iorw indicator field Q5.

*Field 114:* Initially a V. This is iorw indicator field Q6.

*Field 115:* Initially five blanks. This is the address register field. (See *Basic Input/Output Control System*.)

#### File Table—Tape File Prefix

(Additional information on each field in this area is contained in Figure 15.)

Sort Common Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Common
Tape File Prefix	Field 116	COMFILETAB	DCW	5	Numerical
	Field 117	COMBLKCNT	DCW	5	Alphabetic
	Field 118	COMREELCTR	DCW	2	Numerical
	Field 119	COMMRWDRWU	DCW	4	Alphabetic
Disk File Prefix	Field 120	COMRCDSTRK	DCW	2	Numerical
	Field 121	NO LABEL	DCW	2	Numerical
	Field 122	COMSTARTAD	DCW	8	Alphameric
	Field 123	COMENDINAD	DCW	4	Numerical
All Devices	Field 124	COMFILSTOG	DCW	5	Numerical
	Field 125	COMSYMUNIT	DCW	5	Numerical
	Field 126	COMUSEREOF	DCW	5	Numerical
	Field 127	COMFILIND1	DC	1	Alphabetic
	Field 128	COMFILIND2	DC	1	Alphabetic
	Field 129	COMFILIND3	DC	1	Alphabetic
	Field 130	COMFILIND4	DC	1	Alphabetic
	Field 131	COMFILIND5	DC	1	Alphabetic
	Field 132	COMFILIND6	DC	1	Numerical
	Field 133	NO LABEL	DCW	2	Numerical
	Field 134	NO LABEL	DCW	5	Numerical
	Field 135	NO LABEL	DCW	5	Numerical
	Field 136	NO LABEL	DCW	5	Numerical
	Field 137	NO LABEL	DCW	4	Numerical
	Field 138	COMERRORP1	DC	1	Numerical
	Field 139	COMERRORP2	DC	1	Numerical
	Field 140	COMERRORP3	DC	1	Numerical
	Field 141	COMERRORP4	DC	1	Alphabetic
	Field 142	COMERRORP5	DC	1	Alphabetic
	Field 143	COMERROADR	DCW	5	Numerical
	Field 144	COMINTRADR	DCW	5	Numerical

Figure 15. Sort Common Field Description Chart, Fields 116 through 144 (Basic File Table Area)

*Field 116:* Initially set to zeros. This field contains the address of the File Table Extension.

*Field 117:* Initially set to zeros. This field is used to count the blocks in the input file.

*Field 118:* Initially set to zeros. This field contains the reel count.

*Field 119:* Initially RRUU. This field contains the re-wind and rewind unload options, and can be set up directly from control cards.

#### **File Table — Disk File Prefix**

(Additional information on each field in this area is contained in Figure 15.)

*Field 120:* Initially a 2. This field contains the number of blocks per track. The field may be altered by a user-written routine at exit P14.

*Field 121:* Initially set to zeros. This field contains the record count field. It is initialized to zero.

*Field 122:* Initially set to zeros. This field contains the starting track address in the form AMTTTTTHH (A is the access mechanism, M is the module, TTTT is the track number, and HH is the home address identifier).

*Field 123:* Initially set to zeros. This field contains the terminal track address.

#### **File Table — All Devices**

(Additional information on each field in this area is contained in Figure 15.)

*Field 124:* Initially five blanks. This field (the file list origin field) contains the address of the first IORW on the list.

*Field 125:* Initially five blanks. This field (symbolic unit field) contains the symbolic unit address constant for the input, output, work area A, or work area B files.

*Field 126:* Initially five blanks. This field contains the end-of-file address. If the user modifies this field, he must save the address placed there by the sort program, and use that address as the return from his routine. (This address is constant throughout the program.)

*Field 127:* Initially a V. This is File Table indicator field F1.

*Field 128:* Initially a V. This is File Table indicator field F2.

*Field 129:* Initially a V. This is File Table indicator field F3. This field should not be altered.

*Field 130:* Initially a V. This is File Table indicator field F4. The numerical portion of this character must remain a 5.

*Field 131:* Initially a V. This is File Table indicator field F5. The numerical portion of this character must remain a 5.

*Field 132:* Initially an 8. This is File Table indicator field F6. If the input file is on tape, this number is changed to a 4 in Phase 1.

*Field 133:* Initially set to zeros and unchanged by the sort program. This field is used by iocs for storing index register information.

*Field 134:* Initially set to zeros and unchanged by the sort program. This field contains the high-order address of the input/output area.

*Field 135:* Initially set to 2800 and unchanged by the sort program. This field contains the block size.

*Field 136:* Initially set to zeros and unchanged by the program. This field contains the low-order address of the current block of data records.

*Field 137:* Initially set to zeros and unchanged by the program. This field is used by iocs for storing data record size information.

*Field 138:* Initially blank. This is File Table error indicator field 1.

*Field 139:* Initially blank. This is File Table error indicator field 2.

*Field 140:* Initially blank. This is File Table error indicator field 3.

*Field 141:* Initially blank. This is File Table error indicator field 4.

*Field 142:* Initially blank. This is File Table error indicator field 5.

*Field 143:* Initially set to zeros. This field contains an error routine address. If the user has a separate error routine, the entry-point should be placed here.

*Field 144:* Initially set to zeros. This field contains a service routine address. If the user has a separate service routine, the entry-point address should be placed here.

*Field 145:* This field is the last field in the Sort Common area. The field contains a group mark with word mark (see Figure 16).

#### **Linkage Symbols**

The sort programs produced from the Generalized Disk Sorting Program make extensive use of linkage symbols for communication between the subroutines that comprise each phase. Certain of these symbols may be utilized or referred to by user-written modification routines; the user may also utilize any reasonable number of his own linkage symbols in his routines. The

Sort Common Field	Label	Operation Setting up Field	Number of Positions	Nature of Constants	Location in Sort Common
Field 145	COMGRPMARK	DCW	1	Alphabetic	479

Figure 16. Sort Common Field Description Chart, Field 145

initial character of all disk sort program linkage symbols is the letter D. To avoid possible duplication, the user should refrain from using the letter D as the first character in his own linkage symbols.

The following list contains descriptions of those sort program linkage symbols that may be referred to by user-written modification routines. The list includes linkage symbols that provide access to print and console typewriter routines that remain in core storage at all times. If a linkage symbol should be used by a modification routine at a particular exit point, the name of that exit point is indicated in the linkage symbol description. The "Exit Point Description" subsection of this section lists, for each exit point, the sort program linkage symbols that may be referred to by the user's added programming at that point.

LINKAGE SYMBOL	DESCRIPTION
DC01/	Symbolic address of the highest core-storage location of the Sort Common Area. This field remains in core storage throughout the program.
DC02/	Symbolic address of the first core-storage location above the Sort Common Area. This field remains in core storage throughout the sort program.
DMGA/	Address of the one-character NOP instruction in the last position of the control card reading routine. The instruction immediately precedes the common area checking routine, or the user-written modification routines at exit GA2, if that exit point has been activated.
DMGB/	Address of the one-character NOP instruction in the last position of the common area checking routine. This instruction immediately precedes the routine that links the General Assignment Phase to either Phase 1 or the user-written modification routines at exit GA3, if that exit point has been activated.
D111/	Symbolic address of the point in the Phase 1 running program to which a user-written routine at exit point P11 must return if the routine has inserted a data record into the Record Storage Area.
D112/	Symbolic address of the point in the Phase 1 running program to which a user-written routine at exit P11 must return if the routine has: (1) shortened the record by using the method of shortening the record in the input area and moving the diminished record to the Record Storage Area; (2) lengthened the record using the method of moving the record from the input area to the Record Storage Area and performing the expansion there; or (3) shortened, altered, or lengthened records by moving the record to a work area, performing the desired modification, and moving the modified record to the Record Storage Area.
D113/	Symbolic address of the point in the Phase 1 running program to which a user-written routine at exit P11 must return if the routine has deleted a record in the input area.
DB01/	Symbolic address of a field that counts all the records to be processed by the sort. This field remains in core storage only during Phase 1.

LINKAGE SYMBOL	DESCRIPTION
DI38/	Symbolic address of a seven-character, unsigned numerical field used to count the number of records inserted into the input file in Phase 1.
DI39/	Symbolic address of the seven-character, unsigned numerical field used to count the number of records deleted from the input file in Phase 1.
DH51/	Symbolic address of the core-storage location containing the five-digit address of the high-order position of the last record moved to the output area in Phase 3.
DH52/	For user-written routines at exit point P31, this linkage symbol is the symbolic address of a field containing the five-digit address of the high-order position of the last record moved to the output area. For user-written routines at exit point P32, this linkage symbol is the symbolic address of a field containing the five-digit address to which the next output record is to be moved.
DH53/	Symbolic address of a five-digit numerical field used to count the total number of characters in the output block area currently being filled. This field is used only if Form 4 records are being processed. The field remains in core storage throughout Phase 3.
DH55/	Symbolic address of a five-digit, signed numerical field used to indicate the number of positions remaining in the output area. This field is used only if Form 4 records are being processed, and remains in core storage throughout Phase 3.
DH56/	Symbolic address of a seven-digit, signed numerical field used to count the total number of data records inserted into the final output file. This field remains in core storage throughout the execution of Phase 3.
DH59/	Symbolic address of a seven-digit, signed numerical field used to count the total number of data records deleted from the final output file. The field remains in core storage throughout Phase 3.
DH60/	Symbolic address of a core storage location containing a word mark that may be used by a user's routine as a word mark switch. If the current record coming out of the merge is equal to the preceding record (already in the output area), the sequence check in the merge network sets this word mark. The sort program does not clear the word mark. If the user wishes to utilize this word mark as a switch, his routine must clear the word mark. No other bit position in the character at this location should be altered by the user. The one-position field remains in core storage throughout Phase 3.
DH61/	Symbolic address of a core-storage location containing a last-record word mark switch. The word mark is set when the last record of the sort is about to be moved to the output area. The one-position field remains in core storage throughout Phase 3.
DH62/	Symbolic address of a four-digit, positively signed numerical field used to start an early high padding check or for eliminating all high padding records (see "Option E," under "Padding," in "Features and Specifications"). If the user wishes the sort program to check for high padding records in Phase 3 before

LINKAGE SYMBOL	DESCRIPTION
	the normal check of the last block of records, he places in this location the exact or approximate number of high padding records present in the input file. The program will check for that number in addition to checking the last block. The field remains in core storage throughout Phase 3.
DH82/	Symbolic address of a seven-digit, unsigned numerical field used, for variable-length records, to count the total number of data records in the output file. This counter remains in core storage throughout Phase 3.
DH83/	Symbolic address of a three-digit, signed numerical field used to test the status of the output area. The field can be used by added routines at exit P32 only when the routines are inserting records into the output file. The field remains in core storage throughout Phase 3.
DH2M/	Symbolic address of an instruction to which a user-written routine at exit P32 should return if the routine has inserted a record into the final output file. This instruction remains in core storage throughout Phase 3.
DHM2/	Symbolic address of an instruction to which a user-written routine at exit point P32 should return if, in inserting or lengthening Form 4 records, the routine has determined that the current output block should be written. After the write has been issued, the sort program will return to the user's routine. The instruction remains in core storage throughout Phase 3.
DHM6/	Symbolic address of an instruction to which a user-written routine, at exit point P31 or P32, should return if the sort program is not to move the current record from the input area to the output area. The sort program will determine the next sequential record before re-entering exit points P31 or P32. The purpose of this return is to enable the user's routine to perform further processing, if necessary, at that particular point in the output file. This instruction remains in core storage throughout Phase 3.
DHMP/	Symbolic address of the low-order position of the B-address of the instruction that moves each record from the input area to the output area. The instruction is in core storage throughout Phase 3.
DHOC/	Symbolic address of the low-order position of the B-address of an instruction that moves a group mark to the position following the last data record in the output area. The instruction is in core storage throughout Phase 3.
DP00/	Symbolic address of a word mark switch that a user may set if he wishes to utilize the console typewriter in place of the SPR. The user branches to the print routine at DP01/; if the word mark is present, the message will be typed out on the console typewriter. This switch remains in core storage throughout the sort.
DP01/	Symbolic address of the first instruction of a print routine that will write on the Standard Print Unit (SPR) the contents of the print positions in the area defined by linkage symbol DP02/. This first instruction stores the B-address register in the address portion of

LINKAGE SYMBOL	DESCRIPTION
	the last instruction of the print routine (an unconditional branch), allowing the return to the next sequential instruction in the user's added programming. The print routine remains in core storage throughout the sort.
DP02/	Symbolic address of the high-order position (a carriage-control character with a word mark) of a 134-position print area. The last character, or low-order position of the area is a group mark with word mark. This area remains in core storage throughout the sort, and may be used any time during the sort.
DP03/	Symbolic address of the second position of the 134-character print area at DP02/. This is the first data position of the print area. Linkage symbol DP03/ provides access to the 132-position data area; this data area may be used any time during the sort.
DP04/	Symbolic address of the next-to-last position of the 134-character print area at DP02/. This is the last of the 132 data positions in the area.
DP05/	Symbolic address of the first instruction of a routine that will clear the first 133 positions of the print area at DP02/. The instruction stores the B-address register in the return address location, allowing the return to the next sequential instruction in the user's added programming. The routine remains in core storage throughout the sort.
DP06/	Symbolic address of the first instruction of a routine that will type, on the console typewriter, the message located at the address specified in linkage symbol DP07/. This routine remains in core storage throughout the sort.
DP07/	Symbolic address of the field containing the address of the message to be typed on the console typewriter. This field remains in core storage throughout the sort.
DP08/	Symbolic address of a word mark switch that a user may set if he wishes to type a message and then go to a diagnostic end-of-program routine. The word mark switch remains in core storage throughout the sort program.
DP11/	Symbolic address of the first instruction of a diagnostic end-of-program routine. This routine remains in core storage throughout the sort.

### Exit Point Descriptions

This section contains detailed information on each of the exit points provided by the Generalized Disk Sorting Program. (For a summary of the exit point locations and suggested uses, see Figure 9.) Sort-program conditions governing the use of each exit point are specified in the descriptions. In each case, the description is limited to covering those factors essential to satisfactory program performance. To meet the user's individual requirements, the modification routine must, of course, contain the additional instructions necessary to accomplish these requirements. The programming technique used within the framework

of the cited specifications for each exit is left to the discretion of the user.

The format used for the description of each of the exit points is as follows:

*Location and Duration:* Describes where in the program the exit point will be situated, and for how long it will exist.

*Return Linkages:* Describes the possible return points from the exit point.

*Linkage Symbols:* Lists those linkage symbols that may be utilized by the user's routine at the specific exit point.

*Required Index Register Conditions:* Specifies those index registers that may be used by the added programming, and which, if used, must have their contents saved and restored.

*Comments on Use:* Describes some of the functions for which the exit point may be used.

### General Assignment Phase Exit Points

#### Exit CA1

*Location and Duration:* This exit point provides access to an area in which the user may retain information throughout the execution of the sort program. It is physically located below all the program routines, immediately above Sort Common.

*Return Linkages:* Routines executed in the CA1 area can be entered only from a routine at one of the other exit points or from an iocs exit. Routines at CA1 must, therefore, return to an added routine at some other exit. The return must be provided either by the routine from which the CA1 routine was entered, or by having SBR and branch instructions in the first and last positions, respectively, of the routine at CA1. In the latter case, the B-address would be stored in the terminal branch address, resulting in the return to the next sequential instruction of the routine from which CA1 was entered.

*Linkage Symbols:* Routines in the CA1 area may use linkage symbols DC01/, DC02/, DMGA/, DMGB/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* The index register conditions that apply to routines executed in CA1 are determined by the point in the program at which the routines are executed. Routines in CA1 that are branched to from other sort exit points must adhere to the restrictions at those points. If the routines in CA1 are branched to from any other point, all index registers used should be saved and restored.

*Comments on Use:* The primary purpose of CA1 is to provide the user with an area in which he may save constants, counters, and routines to be used throughout the execution of a sort program. The added pro-

gramming may include, for example, the user's iocs tape-label, service, and error routines.

#### Exit GA1

*Location and Duration:* This is the first General Assignment Phase exit point for the sort. If activated it occurs following the initialization of common and prior to reading the sort control cards. Routines at this point are entered once and are executed in-line after the preceding instructions. The added programming remains in core storage throughout the General Assignment Phase.

*Return Linkages:* The normal return from a routine at GA1 is to the next sort program instruction following the routine. If the control card reading routine (the routine that reads the sort program control cards and places the information in the Sort Common area) is to be bypassed, the return can be to the linkage symbol DMGA/ (see "Linkage Symbols" in this section). If the user wishes to bypass the common area checking routine (the routine that checks Sort Common control information for validity and consistency), the return can be to linkage symbol DMGB/, or to the user's added routine at exit point GA3.

*Linkage Symbols:* Routines at exit point GA1 may use linkage symbols DC01/, DC02/, DMGA/, DMGB/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* Routines at this exit point may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* The purpose of this exit point is to enable the user to supply his own control information in Sort Common, if desired; this can eliminate the necessity for reading some or all of the sort control cards. If the user completely sets up Sort Common himself, he may bypass the common area checking routine. This, however, should be done only if the user is familiar with all of the functions and properties of the Sort Common area.

#### Exit GA2

*Location and Duration:* If activated, this exit point occurs in the General Assignment Phase of the sort program. The exit point follows the control card reading routine, and precedes the common area checking routine. Routines at this point are entered once, and are executed in-line after the preceding instructions. The added programming remains in core storage throughout the General Assignment Phase.

*Return Linkages:* The normal return from a routine at GA2 is to the next sort program instruction following the routine. If the common area checking routine is to be bypassed, the return can be to the linkage symbol DMGB/ or to the user's added routine at exit point GA3.



*Linkage Symbols:* Routines at exit point GA2 may use linkage symbols DC01/, DC02/, DMGB/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* Routines at GA2 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* The exit may be used separately, or in conjunction with exits GA1 and GA3 to set up or modify the contents of Sort Common. Bypassing the common area checking routine should be done with caution.

#### **Exit GA3**

*Description:* If activated, this exit point follows the execution of the General Assignment Phase of the sort and is followed only by the link to the Resident Monitor to load Phase 1. Routines at this point are entered once, and are executed in-line after the preceding instructions. The routines remain in core storage throughout the General Assignment Phase.

*Return Linkages:* The normal return from the routine at GA3 is to the next sort program instruction following the routine.

*Linkage Symbols:* Routines at exit point GA3 may use linkage symbols DC01/, DC02/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, DP00/, and DP11/.

*Required Index Register Conditions:* Routines at GA3 may use index registers 01 to 13 without having to save and restore the index register contents.

*Comments on Use:* This exit point is provided to enable the user to perform any final general-assignment function prior to entering Phase 1 of the sort program.

### **Phase 1 Exit Points**

#### **Exit P11**

*Location and Duration:* If activated, this exit point occurs at the point in the running program when each record is about to be moved from the input area to the Record Storage Area. Routines at this exit point are entered once for each input data record; if modification action is taken, the user's added routine should return to one of the linkage symbols indicated below. The added programming at this exit point is executed in-line after the preceding instructions, and remain in core storage throughout Phase 1.

*Return Linkages:* The normal return from a routine at P11 is to the next sort program instruction following the routine. If a deletion is performed, the return should be to D113/. If the user, to alter, shorten, or lengthen records, has moved a record to the Record Storage Area, the return should be to D112/. If a record is inserted in the Record Storage Area, the return should be to D111/.

*Linkage Symbols:* Routines at exit P11 may use linkage symbols DC01/, DC02/, DB01/, D111/, D112/, D113/, DI38/, DI39/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* At the time the routine at exit P11 is entered, the contents of index registers 11 and 08 are as follows: index register 11 contains the address of the high-order position of the data record about to be moved from the input area to the Record Storage Area (the "current" input data record); index register 08 contains the address of the high-order position of the Record Storage Area field to which the current input data record is to be moved. These two index registers may be altered as described under "Comments on Use." If the added programming uses any other index registers, the contents of those registers must be saved and restored.

*Comments on Use:* To delete an input data record, the user's added routine must perform the following functions:

1. Determine whether or not the current data record in the input area should be deleted. If the record should be deleted, perform steps 2, 3, and 4, below. If the record should not be deleted, branch to the next sequential sort program instruction.
2. Increment the counter at DI39/ by one.
3. Add the length of the data record being deleted to index register 11.
4. Return to the sort program via an unconditional branch to D113/. Use of this return enables the sort program to re-enter the exit prior to moving the following record to the Record Storage Area.

One record in the file must be read into the sort before any records can be deleted.

To insert records into the sort, the user's added routine must perform the following functions:

1. Determine whether or not a record should be inserted at the current point in the Record Storage Area. If a record should be inserted, perform steps 2, 3, 4, and 5, below. If a record should not be inserted, branch to the next sequential sort program instruction.
2. Increment the counters at DI38/ and DB01/ by one.
3. Using an MRCD instruction, move the record from where it is located to the address 0 + X8.
4. Increment index register X8 by the data record length or maximum data record length specified in the RECLN parameter. (This is the value in COMRECLNTH — see Field 8, "Sort Common Area" section.)
5. Return to the sort program via an unconditional branch to D111/. Use of this return enables the program to re-enter the exit prior to moving the current data record in the input area to the Record Storage Area.

This permits the insertion of more than one record at a specific point in the input file.

To *alter* records in the input area, the user's added routine must perform the following functions:

1. Determine whether or not the current input data record should be altered. If the record should be altered, perform step 2, below. If the record should not be altered, branch to the next sequential sort program instruction.

2. Perform the desired alteration (and "fall through" to the next sequential sort program instruction).

To *shorten* a record without using a work area, the user's routine must perform the following functions:

1. Determine whether or not the current input data record is to be shortened. If the record is to be shortened, perform steps 2, 3, and 4, below. If the record is not to be shortened, branch to the next sequential sort program instruction.

2. Shorten the record in the input area by repositioning the record mark. Using an MRCR instruction, move the shortened record from the address  $0 + X11$  to the address  $0 + X8$ .

3. Add the *input* data record length (the size of the current input data record before shortening) to index register 11.

4. Return to the sort program via an unconditional branch to D112/. Use of this return enables the program to re-enter the exit prior to moving the next data record from the input area to the Record Storage Area.

To *lengthen* a record without using a work area, the user's routine must perform the following functions:

1. Determine whether or not the current input data record is to be lengthened. If the record is to be lengthened, perform steps 2, 3, and 4, below. If the record is not to be lengthened, branch to the next sequential sort program instruction.

2. Using an MRCR instruction, move the record from the input area address  $0 + X11$  to the Record Storage Area address  $0 + X8$ . Perform the desired record lengthening in the Record Storage Area.

3. Add the *input* data record length (the size of the current input data record before lengthening) to index register 11.

4. Return to the sort program via an unconditional branch to D112/. Use of this return enables the program to re-enter the exit prior to moving the next data record from the input area to the Record Storage Area.

To *shorten*, *alter*, or *lengthen* records using a work area, the user's routine must perform the following functions:

1. Determine whether or not the current input data record is to be modified. If the record is to be modified, perform steps 2, 3, 4, and 5, below. If the record is not to be modified, branch to the next sequential sort program instruction.

2. Using an MRCR instruction, move the record from the input area address  $0 + X11$  to the user's work area.

3. After performing the desired record modification, use an MRCR instruction to move the record from the user work area to Record Storage Area address  $0 + X8$ .

4. Add the specified *input* data record length (the size of the current input data record before any modification action) to index register 11.

5. Return to the sort program via an unconditional branch to D112/. Use of this return enables the program to re-enter the exit prior to moving the next data record from the input area to the Record Storage Area.

Exit point P11 cannot be activated if the user has specified the parameter QMOD on the Sort Definition (DSORT) card (see "Program Definition").

#### Exit P12

*Location and Duration:* If activated, this exit point occurs immediately after the loading of Phase 1 of the sort and before any assignment routines are executed. The added programming remains in core storage only during the assignment portion of Phase 1. Routines at this exit point are entered once, and are executed in-line following the preceding instructions.

*Return Linkages:* The return from a routine at P12 should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at exit point P12 may use linkage symbols DC01/, DC02/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* Routines at P12 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* This exit point provides a location at which the user may include the assignment routines necessary for his Phase 1 modifications; the user assignment routines will be executed prior to the execution of the Phase 1 assignment program.

#### Exit P13

*Location and Duration:* If activated, this exit point occurs in the Phase 1 assignment program at a point at which the user may alter the File Table, File Table Extension, and iorw for the output file. Routines at this exit point are entered once and reside in core storage only during the execution of the Phase 1 assignment program. The added programming is executed in-line after the preceding instruction.

*Return Linkages:* The return from a routine at P13 should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at exit point P13 may use linkage symbols DC01/, DC02/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* Routines at P13 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* The user may, at this exit point, modify the File Table, File Table Extension, and iorw areas in Sort Common to produce the tables necessary for the *output* file of his application. Following exit P13, the Phase 1 assignment program will move the output File Table and iorw to their respective running program areas.

#### Exit P14

*Description:* If activated, this exit point occurs in the Phase 1 assignment program at a point at which the user may alter the File Table, File Table Extension, and iorw for the input file. Routines at this exit point are entered once and reside in core storage only during execution of the Phase 1 assignment routines. The added programming is executed in-line after the preceding instructions.

*Return Linkages:* The return from routines at exit point P14 should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at P14 may use linkage symbols DC01/, DC02/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* Routines at exit point P14 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* The user may, at this exit point, modify the File Table, File Table Extension, and iorw area in Sort Common to produce the tables necessary for the *input* file of his application. Following exit P14, the Phase 1 assignment program will move the input File Table and iorw to their respective running program areas.

### Phase 3 Exit Points

#### Exit P31

*Location and Duration:* If activated, this exit point occurs at a point at which the user can have access to each data record as it comes out of the merge network in Phase 3. In addition, the previous record moved to output is still available in the output area. Exit P31 resides in core storage throughout execution of Phase 3. Routines at this exit point are entered for each output data record after the first, and are executed in-line after the preceding instructions.

*Return Linkages:* If the current record (the next sequential record as just determined by the merge network) is to be summarized with the preceding record (already in the output area), the return from a routine at exit P31 should be to linkage symbol DHM6/. If the

record should not be summarized with the preceding record, the return should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at exit point P31 may use linkage symbols DC01/, DC02/, DH52/, DH53/, DH55/, DH56/, DH59/, DH60/, DH61/, DH83/, DHM2/, DHM6/, DHMP/, DHOC/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* At the time routines at exit P31 are entered, index register 01 contains the input area address of the high-order position of the current record coming out of the merge network. If the added programming uses any other index registers (02 through 13), the contents of those registers must be saved and restored.

*Comments on Use:* The location of this exit point is especially conducive to the summarization of data records. User routines at this exit point may examine each record, other than the first, as it comes out of the merge network; the records will be examined in the properly sorted sequence. Index register 01 contains the input area address of the high-order position of the record coming out of the merge network, and should be used in performing the summarization. The preceding record (already in the output area) is also available; the symbolic address of the high-order position of the preceding record is DH52/. If the current record is to be *summarized* with the preceding record, and then deleted, the user's added routine should perform the following functions:

1. Determine whether or not the current record should be summarized with the preceding record. If it should be summarized, perform steps 2, 3, and 4, below. If it should not be summarized, branch to the next sequential sort program instruction.
2. Increment the counter at DH59/ by one.
3. Perform the summarization using index register 01 (location of the high-order position of the current record) and linkage symbol DH52/ (location of the high-order position of the preceding record).
4. Branch unconditionally to DHM6/. Use of this return enables the sort program to eliminate the moving of the current data record to the output area; the current record (already summarized) is therefore deleted. The sort program, through the merge network, determines the next sequential record and re-enters the exit point.

To assist in the summarization of equal records, the sort program provides the capability for a word mark switch at DH60/. If the control data word of the current record coming out of the merge is equal to that of the preceding record, a sequence checking routine of the sort program sets the word mark at DH60/. This word mark, if set, is not cleared by the program; if the user wishes to utilize the switch, he must provide the coding

to interrogate the switch and, if it is set, take the desired action and clear the word mark.

#### Exit P32

*Location and Duration:* If activated, this exit point occurs in Phase 3 at the point at which the current data record (the next sequential record as determined by the merge network) is about to be moved from the input area to the output area. Routines at this exit point are entered for each data record in the input area, and are executed in-line after the preceding instructions. The added programming remains in core storage throughout Phase 3.

*Return Linkages:* If no action is taken by the routines at P32, the return from the added routine should be to the next sequential sort program instruction. If a record is inserted by the routines at this exit, the return should be to DH2M/. If a record is deleted by the routines at this exit, the return should be to DHM6/. If a record is altered or shortened in the input area, the return should be to the next sequential sort program instruction. If a record is lengthened in the output area, the return should be to DHM6/. If a record is lengthened, shortened, or altered in a user work area, the return should be to DHM6/.

*Linkage Symbols:* Routines at exit P32 may use linkage symbols DC01/, DC02/, DH51/, DH52/, DH53/, DH55/, DH56/, DH59/, DH60/, DH61/, DH82/, DH83/, DH2M/, DHM2/, DHM6/, DHMP/, DHOC/, DP00/, DP01/, DP02/, DP03/, DP04/, DP05/, DP06/, DP07/, DP08/, and DP11/.

*Required Index Register Conditions:* At the time routines at P32 are entered, index register 01 contains the input area address of the high-order position of the current record. If the added programming uses any other index registers (02 through 13), the contents of those registers must be saved and restored.

*Comments on Use:* The definition and function of each of the linkage symbols mentioned in the following descriptions are contained in the "Linkage Symbols" section.

To *insert* a blocked, variable-length record (Form 4) in the output area, the user's routine at exit P32 must perform the following functions:

1. Determine whether or not a record should be inserted at that point in the output file. If a record should be inserted, perform steps 2 through 12, below. If a record should not be inserted, branch to the next sequential sort program instruction.

2. Add the Record Character-Count of the current record to the counter at DH55/.

3. Subtract the Record Character-Count of the record to be inserted from the count at DH55/.

4. If the result of step 3 is negative, the block will not accommodate the record length of the record being inserted. Therefore, branch to DHM2/ to write the block. The return will be to the first instruction of the user's coding at exit point P32.

5. If the result of step 3 is positive, continue to step 6.

6. Add the Record Character-Count of the inserted record to the count at DH53/.

7. Increment the counter at DH82/ by one.

8. Using an MRCWR instruction, move the record being inserted from the user area to the output area. Linkage symbol DH52/ contains the address of the high-order position of the area to which the inserted record should be moved.

9. Store the B-address register at DHMP/ and DHOC/.

10. Increment the counter at DH56/ by one.

11. Decrement the counter at DH83/ by one.

12. Return to the sort program via an unconditional branch to DH2M/. Use of this return enables the sort program to re-enter the exit prior to moving the current data record to the output area; this permits the insertion of additional records at the current point in the output file.

To *insert* a Form 1, 2, or 3 record, the user's added routine must perform the following functions:

1. Determine whether or not a record should be inserted at that point in the output file. If variable-length records are being processed, and a record should be inserted, perform steps 7 through 12 as specified under the instructions for Form 4 records, above. If fixed-length records are being processed, and a record should be inserted, perform steps 8 through 12, above. If a record should not be inserted, branch to the next sequential sort program instruction.

To *delete* a Form 1, 2, or 3 record from the sort, the user's added routine must perform the following functions:

1. Determine whether or not the current record (the next sequential record, as determined by the merge network, about to be moved from the input area to the output area) is to be deleted. If the record is to be deleted, perform steps 2, 3, and 4, below. If the record is not to be deleted, branch to the next sequential sort program instruction.

2. Increment the counter at DH59/ by one.

3. Using an MLNA, move the address at DH51/ to DH52/.

4. Return to the sort program via an unconditional branch to DHM6/. Use of this return enables the sort program to avoid moving the current record (the one to be deleted) to the output area; after determining the next sequential record, the program re-enters the exit.

To *delete* a Form 4 record from the sort, the user's added routine must perform the following functions:

1. Determine whether or not the current record (the next sequential record, as determined by the merge network, about to be moved from the input area to the output area) is to be deleted. If the record is to be deleted, perform steps 2 through 5 below. If the record is not to be deleted, branch to the next sequential sort program instruction.

2. Increment the counter at DH59/ by one.

3. Using an MLNA, move the address at DH51/ to DH52/.

4. Add the Record Character-Count in the current record to DH55/.

5. Return to the sort program via an unconditional branch to DHM6/. Use of this return prevents the sort program from moving the current record (the one to be deleted) to the output area; after determining the next sequential record, the program re-enters the exit.

To *shorten* Form 4 records in the input area, the user's added routine must perform the following:

1. Determine whether or not the current record in the input area should be shortened. Index register 01 contains the address of this record. If the record is to be shortened, perform steps 2, 3, 4, 5, and 6, below. If the record is not to be shortened, branch to the next sequential sort program instruction.

2. Add the Record Character-Count in the current record to the count at DH55/.

3. Adjust the Record Character-Count in the current record to conform to the size of the shortened record.

4. Subtract the new Record Character-Count from the count at DH55/.

5. Using index register 01, perform the desired record modification. The record may be shortened by repositioning the record mark toward the high-order location.

6. Return to the sort program via the next sequential instruction.

To *shorten* Form 1, 2, or 3 records in the input area, or *alter* record forms of any type in the input area, the user's added routine must perform the following functions:

1. Determine whether or not the current record in the input area should be acted upon. Index register 01 contains the address of this record. If the record should be acted upon, perform steps 2 and 3, below. If the record should not be acted upon, branch to the next sequential sort program instruction.

2. Using index register 01, perform the desired shortening or altering action. The record may be shortened by repositioning the record mark toward the high-order location.

3. Return to the sort program via the next sequential instruction.

To *lengthen or shorten* blocked, variable-length (Form 4) records in a user work area, the user's added routine must perform the following functions:

1. Determine whether or not the current record in the input area should be acted upon. Index register 01 contains the address of the high-order position of this record. If the record should be acted upon, perform steps 2 through 13, below. If the record should not be acted upon, branch to the next sequential sort program instruction.

2. Using an MRCWR instruction, move the record from  $0 + X1$  in the input area to the user work area.

3. Add the Record Character-Count in the current record to the count at DH55/.

4. Adjust the Record Character-Count of the record in the user work area to conform to the size of the modified record.

5. Subtract the Record Character-Count of the record in the user work area from the count at DH55/.

6. If the result of step 5 is negative, the block will not accommodate the record length of the record being modified. Therefore, branch to DHM2/ to write the block. The return will be to the first instruction of the user's coding at exit point P32.

7. If the result of step 5 is positive, continue with step 8.

8. Add the Record Character-Count of the record in the user work area to the count at DH53/.

9. Increment the counter at DH82/ by one.

10. After performing the desired action on the record, use an MRCWR instruction to move the record from the user work area to the output address contained in DH52/.

11. Store the B-address register at DHMP/ and DHOC/.

12. Decrement the count at DH83/ by one.

13. Return to the sort program via an unconditional branch to DHM6/.

To *alter* blocked, variable-length (Form 4) records in a user work area, the user's added routine must perform the following functions:

1. Determine whether or not the current record in the input area should be altered. Index register 01 contains the address of the high-order position of this record. If the record should be altered, perform steps 2 through 5, below. If the record should not be altered, branch to the next sequential sort program instruction.

2. Using an MRCWR instruction, move the record from  $0 + X1$  in the input area to the user work area.

3. Add the Record Character-Count of the record in the work area to the count at DH53/.

4. Increment the counter at DH82/ by one.

5. Perform steps 10 through 13 as listed above under

the description beginning, "To *lengthen* or *shorten* blocked, variable-length (Form 4) records. . ."

To *lengthen*, *shorten*, or *alter* Form 1, 2, or 3 records in a user work area, the user's added routine must perform the following functions:

1. Determine whether or not the current record in the input area should be acted upon. Index register 01 contains the address of the high-order position of this record. If the record should be acted upon, perform steps 2, 3 (if applicable), and 4, below. If the record should not be acted upon, branch to the next sequential sort program instruction.

2. Using an *MRCR* instruction, move the record from  $0 + X1$  in the input area to the user work area.

3. If variable-length records are being processed, increment the counter at *DH82* by one.

4. Perform steps 10 through 13 as listed under the description beginning, "To *lengthen* or *shorten* blocked, variable-length records. . ."

#### Exit P33

*Location and Duration:* If activated, this exit point occurs in Phase 3 at the end of the sort program; user-written end-of-program routines may be placed here. The only instructions remaining after this exit point are the sort program's end-of-program linkage to the Resident Monitor. Routines at this exit point are entered once, and are executed in-line after the preceding instructions. The added programming remains in core storage throughout Phase 3.

*Return Linkage:* The only return linkage is to the next sequential instruction.

*Linkage Symbols:* Routines at this exit point may use linkage symbols *DC01*, *DC02*, *DH52*, *DH53*, *DH56*, *DH59*, *DP00*, *DP01*, *DP02*, *DP03*, *DP04*, *DP05*, *DP06*, *DP07*, *DP08*, and *DP11*.

*Required Index Register Conditions:* Index registers 01 through 13 may be used without having to save and restore the index register contents.

*Comments on Use:* Exit point P33 may be used to perform any end-of-program routines desired by the user. If the sort program has been relocated as a phase of a larger program, this exit point must be used to provide the link to the next phase.

#### Exit P34

*Location and Duration:* If activated, this exit point occurs immediately after the loading of Phase 3 into core storage and before any assignment routines are

executed. Routines at this exit point are entered once, and are executed in-line after the preceding instructions. Added programming remains in core storage only during the assignment portion of Phase 3.

*Return Linkage:* The return from routines at this exit point should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at this exit point may use linkage symbols *DC01*, *DC02*, *DH62*, *DP00*, *DP01*, *DP02*, *DP03*, *DP04*, *DP05*, *DP06*, *DP07*, *DP08*, and *DP11*.

*Required Index Register Conditions:* Routines at exit P34 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* This exit point is provided to enable the user to perform any of his own assignment functions prior to the execution of the sort program's Phase 3 assignment program.

#### Exit P35

*Location and Description:* If activated, this exit point occurs in the Phase 3 assignment program at a point at which the user may alter the File Table, output File Table Extension, and *iorw* areas in Sort Common; he can thus make the changes necessary for producing the final output file required for his application. Routines at this exit point are entered once and are executed in-line after the preceding instructions. The added programming remains in core storage only during the execution of the Phase 3 assignment routines.

*Return Linkages:* The return from the routines at this exit point should be to the next sequential sort program instruction.

*Linkage Symbols:* Routines at exit point P35 may use linkage symbols *DC01*, *DC02*, *DP00*, *DP01*, *DP02*, *DP03*, *DP04*, *DP05*, *DP06*, *DP07*, *DP08*, and *DP11*.

*Required Index Register Conditions:* Routines at exit P35 may use index registers 01 through 13 without having to save and restore the index register contents.

*Comments on Use:* The user may, at this exit point, modify the output File Table, File Table Extension, and *iorw* in Sort Common to conform to the sort program output file configuration required for his application. Following Exit P35, the Phase 3 assignment routine will move the File Table (with output File Table Extension address) and the *iorw* to the running program areas for the output file. Prior to moving the File Table and *iorw*, but after the exit, the Phase 3 assignment program will set the output area addresses in the *iorw*'s.

The following terms used in this publication are defined here as they pertain to the Generalized Disk Sorting Program of the IBM 1410/7010 Operating System.

**Added Programming:** The area(s) of core storage reserved by the user for his own utilization during a sort program; also, the instructions or data in these areas. The duration of the areas (i.e., the length of time they will remain in core storage during the execution of the program) depends on the particular exit point at which the added programming is located. The amount of core storage that the user may safely reserve in each phase depends on his particular system. The added programming may or may not contain routines to be executed with the sort program.

**Ascending Sort:** A sort in which the final sequence of records is such that the control data word of each successive record collates equal to or higher than that of the preceding record.

**Assignment Program (Routine):** A set of instructions that establishes basic constants for use by the sort program, or that modifies and/or initializes generalized running program routines to achieve optimum efficiency for a specific application.

**B (also B<sub>s</sub>):** The sort blocking factor. This is the number of data records contained in one sort block. This block is created and utilized by the sort for those read and write operations necessary in the intermediate merging passes. In the Generalized Disk Sorting Program, the sort blocking factor is independent of the input blocking factor (B<sub>i</sub>), the output blocking factor (B<sub>o</sub>), and the number of records that can be internally sorted at one time (G).

**B<sub>i</sub>:** The input blocking factor. This is the number of data records contained in one input block; in an unmodified sort produced from the Generalized Disk Sorting Program, the block is read from the input file directly into the Record Storage Area. The input blocking factor, which can be different from both the sort blocking factor and the output blocking factor, should generally be equivalent to the number of data records contained in one tape or disk record on the input file.

**B<sub>o</sub>:** The output blocking factor. This is the number of data records contained in one output block. In a sorting program produced from the Generalized Disk Sorting Program, two output areas are used to contain the output blocks before they are written on tape or disk. The output blocking factor, which can be different from both the input blocking factor and the sort blocking factor, will be equivalent to the number of data records written on tape or disk in one write operation.

**Binary Insertion Routines:** The routines that sequence up to 12 data records at one time by using a binary search technique and placing record tags in proper order in index registers.

**Block:** Two or more data records grouped so they may be read or written in one operation. Also, generally, any collection of data read or written in one operation.

**BL (Block Length):** The total number of characters in a block.

**Checkpoint:** The periodic recording of certain contents of core storage and any other information necessary to provide a point from which the program can be restarted.

**Collating Sequence:** The relative order of characters upon which a sort or merge is based. The Generalized Disk Sorting Program uses the standard BCD collating sequence.

**Control Data Field:** A contiguous group of characters, within a data record, that forms part or all of the control data word.

A maximum of ten control data fields is permitted by the Generalized Disk Sorting Program; maximum size of a control data field is 999 characters.

**Control Data Word:** A group of characters consisting of one or more control data fields; the sort of the data records will be based on the collating sequence as applied to these characters. If the control data word consists of more than one control data field, the user must specify the major-through-minor order of the fields; this enables the sort program to determine which field to utilize next should an equals situation occur. In the Generalized Disk Sorting Program, the control data fields that make up the control data word may be scattered throughout the record; however, they must not overlap. Maximum size of the control data word is 2,799 characters.

**CW:** The number of characters in a control data word.

**Descending Sort:** A sort in which the final sequence of records is such that the control data word of each successive record collates equal to or lower than that of the preceding record.

**Disk-to-Disk Merge:** A merge in which the data records in the input sequences residing in disk storage are collated to form one output sequence written on disk.

**Disk Record:** A group of characters on disk consisting of one or more data records and control information. Each disk record contains data records read or written in one operation.

**Disk Work File:** One of the two partially sequenced files (disk work file A and disk work file B) alternately providing input to merges during each merge pass in Phase 2 (also see Disk Work Space).

**Disk Work Space:** The areas of disk storage used by a sorting program for its intermediate merging passes. In the Generalized Disk Sorting Program, two work space areas, designated work area A and work area B, are used. The total amount of disk space assigned to each of these areas must be composed of consecutive tracks and contained within one module. A full module (10,000 tracks) must never be defined as a work area. No more than 9,999 tracks should be defined as the disk sort work area.

**Exit Point:** A predetermined point in a program at which routines and data extrinsic to the basic program may be included; the routines may serve to modify certain parts or operations in the program. In the Generalized Disk Sorting Program, the user may activate exit points at certain logical junctures in the program; the exit point will exist only if activated. Added programming at all exit points except one (CA1) will be executed as in-line coding.

**File:** A collection of related data records. For the Generalized Disk Sorting Program, the input file may be contained on one or more reels of tape, one or more modules of disk storage, or on a card reader (if that unit is the Standard Input Unit); the work files may be contained on one or two modules of disk storage; and the output file may be contained on one or more reels of tape, or one or more modules of disk storage.

**File Size:** The total number of data records contained in a file. Also the total number of records processed in one execution of the sort program. Often represented by N.

**Fixed-Length Records:** Records belonging to a file in which all the records have the same number of characters.

**G:** The number of data records that can be internally sorted at one time. Hence, this is the number of data records that can be obtained in the Record Storage Area at one time,



- and the number of data records in each output sequence (with the possible exception of the last) produced in Phase 1.
- Input Blocking Factor:** (See  $B_1$ .)
- Input File:** A collection of related data records introduced as input to the sort program. For the Generalized Disk Sorting Program, the input file may be contained on one or more reels of magnetic tape, one or more modules of disk storage, or on a card reader (if that unit is the Standard Input Unit).
- Internal Merge:** A merge in which the input merge sequences reside in core storage.
- Internal Sort:** The sequencing of a group of data records contained in core storage at one time, based on the collating sequence values of their respective control data words.
- IOCS:** Input/Output Control System.
- IORW:** Input/Output Request Word. A control field used by the IOCS program.
- M:** The merge order. This is the number of sequences that will be combined during a merging operation.
- Major Control Data Field:** The most significant control data field (in determining the output sequence) in a data record.
- Memory-to-Disk Merge:** A merge in which the data records in the input sequences residing in core storage are collated to form one output sequence written on disk. Also, the entire operation that processes each record in the Record Storage Area once in this manner.
- Memory-to-Memory Merge:** A merge in which the record tags of data records in input sequences residing in core storage are collated to form one output sequence in core storage. Also, the entire operation that processes each record in the Record Storage Area once in this manner.
- Merge:** The process by which data records in two or more input sequences are collated at one time to form one output sequence. Also, a program or routine that performs this process.
- Merge Network:** The instructions within a program that determine which of the data records from the input merge sequences should be placed next in the output merge sequence. The determination is based on the relative collating sequence values of the respective control data words being compared.
- Merge Order (Order of Merge):** See "M."
- Merge Pass:** The processing, once through a merge network, of all the data records that have entered the sort program. In a sort, the term is generally used in describing Phase 2 operations only.
- Minor Control Data Fields:** The control data fields, other than the major control data field, in the control data word. Referred to by the sort program, if necessary, in decreasing order of significance, to determine the output sequence.
- Modification, User:** Added programming consisting of routines or data to be executed or used during a sort program.
- N:** File size.
- NMAX:** The maximum number of data records that can be sorted, based on the information supplied in the control cards.
- Order of Merge:** See "M."
- Output Blocking Factor:** See "Bo."
- Output File:** The collection of all the data records arranged, through the processing of the sort program, in one sequence based upon the collating sequence values of the control data fields specified. In the Generalized Disk Sorting Program, the output file may be placed on one or more tape reels, or one or more modules of disk storage.
- Phase:** A portion of the sort or merge program executed as one core storage load.
- Record Storage Area:** The core-storage area in which the data records are stored while being processed by the internal sort.
- Running Program:** The portion of each phase that actually performs the sorting or merging operations on the data file. The running program routines are initialized and/or modified by the assignment routines to execute a specific sort or merge application with optimum efficiency.
- Sequence:** A group of data records whose control data fields are in the desired order according to the collating sequence. The length of each sequence can be one or more data records. Within the merge files, sequence breaks may occur only between blocks of records. Each sequence may, however, consist of several blocks.
- Sort:** A process by which data records in a file are placed in order according to the collating sequence value of the respective control data words of the records. There are several types of sorts, differentiated by the method by which the sequencing is performed.  
Also, a program that performs the process. Merge passes may be included in the process.
- Sort Blocking Factor:** See "B."
- Tag:** A field that contains an address referring to a specific data record in core storage.
- Tape Record:** A group of characters on tape consisting of one or more data records; control information may also be included. Each tape record contains data records read or written in one operation.
- Variable-Length Records:** Records belonging to a file in which the number of characters in each record is not a fixed value, but may vary between prescribed limits.



## Appendix: Timing Information

This appended section provides the user with: (1) timing tables for estimating the amount of time that a sort program will take to process his data file; and (2) timing formulas for calculating this information, if the characteristics of his data file are not covered by the timing tables. The timing tables or the formulas cover cases in which the user has an IBM 1410 or 7010 system, uses 1301 or 2302 Disk Storage for work files, and utilizes 729 iv or 7330 magnetic tape units for input and output. If a module of disk storage (in addition to the modules utilized for work space) is used for the input and/or output files, the sorting times will be approximately the same as those given or calculated for 729 iv input/output.

### Symbols Used

The following list contains the symbols used in the timing formulas and the timing tables. The definitions of the terms for which they stand can be found in the glossary to this publication.

SYMBOL	MEANING
B	Sort blocking factor
B <sub>i</sub>	Input blocking factor
B <sub>o</sub>	Output blocking factor
BIO	Binary insertion order
C	Number of compares
CN	Rate at which data can be transferred to or from magnetic tape.
CW	Length of the control data field
CYLA	Number of cylinders required in disk work area A
CYLB	Number of cylinders required in disk work area B
G	The number of records that can be internally sorted at one time. Hence, this is the number of data records contained in one output sequence created by Phase 1
H <sub>A</sub>	Number of tracks required in disk work area A
H <sub>A</sub>	Number of tracks required in disk work area A for the output of Phase 1
H <sub>B</sub>	Number of tracks required in disk work area B
L	Data record length
M <sub>2</sub>	Merge order of Phase 2
M <sub>3</sub>	Merge order of Phase 3
M <sub>m</sub>	Merge order of the memory-to-memory merge in Phase 1
M <sub>d</sub>	Merge order of the memory-to-disk merge in Phase 1
MOD A	The disk storage module containing work space A
MOD B	The disk storage module containing work space B
MACH	Machine size (total core-storage capacity of the computer)
MON	System Monitor size (amount of core storage required by the System Monitor)

SYMBOL	MEANING
N	File size
P	Number of Phase 2 passes
P2CODE	Size of Phase 2 coding (currently 6550 if one control field, 6770 if multiple control fields)
R	Average disk seek time
S	Number of sequences
S <sub>1</sub>	Number of sequences, Phase 1
[ ]	Round to the nearest higher integer
[ ]	Round to the nearest lower integer
T <sub>i</sub>	Phase 1 sorting time (in milliseconds per record)
T <sub>ii</sub>	Phase 2 sorting time (in milliseconds per record)
T <sub>iii</sub>	Phase 3 sorting time (in milliseconds per record)

### Timing Formulas

The following timing formulas will enable the user to estimate sorting times for those types of files not covered in the timing tables. The formulas assume that the program has not been modified by the user's added routines. Inclusion of user-written modification routines will increase the total execution time by the amount of time required to execute the modification routines plus an indeterminate amount of sort processing time; the latter depends on the nature of the routines added.

The formulas also assume that the records in the data file are of fixed length; if the user is processing variable-length records, the value used for L should be the *maximum* data record length.

A complete list of the general assumptions for the timing formulas follows:

1. The input blocking factor is equal to the sort blocking factor, which is equal to the output blocking factor, which is equal to 2,800 divided by the data record length; or,

$$B_i = B = B_o = \left\lfloor \frac{2,800}{L} \right\rfloor \text{ records}$$

2. IBM 729 iv or 7330 magnetic tapes are used for input to Phase 1 and output from Phase 3.

3. Two modules of disk storage, both on the same data transmission channel, are used for work space.

4. There are no user-written modification routines included (see above).

5. Fixed-length data records are being processed (see above).

6. The maximum size of the System Monitor is 20,000 positions of core storage.

7. The program uses a single control data field. When multiple control data fields are used, the amount of additional time necessary depends on the contents and nature of the control data fields in the user's file.

8. The addresses for each disk work file start at the beginning of a cylinder.

9. One input/output data transmission channel is used.

### Application of the Timing Formulas

The following steps should be taken to compute the sorting time for a given application. The formula tables at the end of this section will provide values for various factors that will serve as constants in the formulas.

1. Calculate the sort blocking factor (B) and the number of records that can be internally sorted at one time (G).

2. Calculate the number of Phase 1 output sequences.

3. Calculate the merge order for Phase 2.

4. Calculate the number of Phase 2 passes required.

5. Calculate the merge order for Phase 3.

6. Calculate the sorting time for Phase 1 ( $T_I$ ), Phase 2 ( $T_{II}$ ), and Phase 3 ( $T_{III}$ ), based on the machine configuration.

7. Calculate the total sorting time ( $T_I + T_{II} + T_{III}$ ). The result will be in milliseconds per record.

### B and G Calculation

The blocking factor used during the sort program is equivalent to the number of data records that can completely fit in one 2,800-character disk record. Thus,

$$B = \frac{2,800}{L}$$

Phase 1 will produce sequences of up to 5 or 10 blocks, depending on available core storage. Generally speaking, if the computer has a capacity of 60,000 positions of core storage, the number of records that can be internally sorted at one time (G) will be five times the sort blocking factor; or,  $G = 5B$ . If the computer has a capacity of 80,000 or 100,000 positions,  $G = 10B$ . The generated sequences are distributed on both work areas; the first sequence is written on work area A, the second on work area B, the third on work area A, etc. The alternate process continues until the whole file has been written on disk. The initial write operation for each work area is to the first track of the first assigned cylinder; the writing then proceeds on sequential tracks in each area.

### Calculation of the Number of Phase 1 Output Sequences

The number of sequences created by Phase 1 is equal to the number of data records in the file divided by the Phase 1 output sequence length.

$$S = \left\lceil \frac{N}{G} \right\rceil$$

### Calculation of the Phase 2 Merge Order

The merge order in Phase 2 is a function of the machine size, the System Monitor size, and the size of the Phase 2 coding.

$$M_2 = \frac{\text{MACH} - \text{MON} - \text{P2CODE} - 8,535}{2,845}$$

The tables in this section as well as the Timing Tables that follow assume a Phase 2 merge order of either 8 (for 60K machines) or 12 (for 80-100K machines). If, for any reason, this merge order cannot be accommodated, the foregoing formula should be used.

### Calculation of the Number of Phase 2 Passes Required

Each Phase 2 pass consists of a series of up to eight-way (for 60K machines) or up to twelve-way (for 80-100K machines) merges. Each merge pass reduces the total number of sequences being sorted by a factor

equal to the merge order; or, to 2  $\left( \left\lceil \frac{S}{M_2} \right\rceil + A \right)$

sequences. A equals 0 if  $\frac{S}{2}$  is an even multiple of  $M_2$ ; otherwise, A equals 1.

The number of merge passes required in Phase 2 is that number that will reduce the amount of sequences to eight or less (60K machine), or to twelve or less (80-100K machine). Once the total number of sequences has been reduced to this number, Phase 3 can be entered.

Table 1 shows the number of Phase 2 passes required based on the number of sequences from Phase 1.

### Calculation of the Phase 3 Merge Order

The merge order in Phase 3 is a function of the number of sequences created by Phase 1, the merge order, and the number of Phase 2 passes.

$$M_3 = \left\lceil \frac{S_1}{M_2^P} \right\rceil$$

Table 2 can be used in determining the Phase 3 merge order.

### Example of the Phase 3 Merge Order Calculation

Assume that the input file consists of 5,000 records, each 80 characters long; the computer used is a 1410 with 60,000 positions of core storage. The following steps can be used to calculate the Phase 3 merge order:

1. Calculate the sort blocking factor.

$$B = \left\lfloor \frac{2,800}{L} \right\rfloor, B = \left\lfloor \frac{2,800}{80} \right\rfloor$$

B = 35 records per block

2. Calculate the number of records that can be internally sorted at one time. For a machine with 60,000 positions of core storage,  $G = 5B$ .  $G = 175$  records.

3. Calculate the number of Phase 1 output sequences.

$$S_1 = \left\lceil \frac{N}{G} \right\rceil, S_1 = \left\lceil \frac{5,000}{175} \right\rceil, S_1 = 28+, S_1 = 29$$

4. Using the result obtained from 3, consult Table 1 to find the number of Phase 2 passes required.  $P = 1$ . The formula for determining the Phase 3 merge order is

$$M_3 = \left\lceil \frac{S}{M_2^P} \right\rceil, M_3 = \left\lceil \frac{29}{8^1} \right\rceil, M_3 = 4.$$

The merge order for Phase 3 is 4. An alternate to the calculation in 4 involves consulting Table 2. The Phase 3 merge for 29 Phase 1 sequences is  $\left\lceil \frac{S}{8} \right\rceil M_3 = \left\lceil \frac{29}{8} \right\rceil M_3 = 4$ .

### Calculation of the Sorting Time for Phases 1, 2, and 3

The method of calculating sorting time for each of the computer-disk equipment combinations on which the sort program can be run (1410-1301, 1410-2302, 7010-1301, 7010-2302) is basically the same. Thus, the first of the following sections (1410-1301) contains the complete set of formulas for these calculations. Subsequent sections indicate the modifications to these formulas necessary for calculating time when using the other equipment configurations.

#### 1410-1301 Timing: Phase 1 Time ( $T_1$ ) Calculation Formulas

The total Phase 1 sorting time for a 1410-1301 configuration consists of:

1. The tape read time or the binary insertion time, whichever is greater.
2. The input iocs time.
3. The memory-to-memory merge (if required) time.
4. The output iocs time.
5. The disk write time or the memory-to-disk merge time, whichever is greater.

*Tape Read Time or Binary Insertion Time ( $T_1$ ):* The formula for the tape read time for IBM 729 IV units is derived as follows:

$$\frac{7.1 + .016 (2,800)}{B_i} = \frac{51}{B_i}$$

$$729 \text{ IV tape read time} = \frac{51}{B_i}$$

The formula for the tape read time for IBM 7330 units is derived as follows:

$$\frac{10.8 + .05 (2,800)}{B_i} = \frac{150.8}{B_i}$$

$$7330 \text{ tape read time} = \frac{150.8}{B_i}$$

The binary insertion time =

$$C (.1883 + .009CW) + \frac{3.1395}{BIO} + \frac{53.981}{G} + 1.7318 + \frac{.568}{B} + .0045L$$

The number of compares ( $C$ ) can be found in Table 3.

The binary insertion order ( $BIO$ ) =  $\lceil \sqrt[3]{G} \rceil$

$T_1$  will be the tape read time or the binary insertion time, whichever is greater.

*Input IOCS Time ( $T_2$ ):*

$$T_2 = \frac{2.322}{B}$$

*Memory-to-Memory Merge Time ( $T_3$ ):*

$$T_3 = T_m + .472 + M_m \left( .016 + \frac{.899}{G} \right) + .448$$

The merge time ( $T_m$ ) can be found in Table 4.

The merge order ( $M_m$ ) for the memory-to-memory merge =  $\lceil \sqrt[3]{G} \rceil$

*Output IOCS Time ( $T_4$ ):*

$$T_4 = \frac{8.1}{B}$$

*Disk Write Time or Memory-to-Disk Merge Time ( $T_5$ ):*

$$\text{The disk write time} = \frac{51}{B}$$

The memory-to-disk merge time =

$$T_m + \frac{1.026}{B} + .416 + .01575L + M_d \left( .016 + \frac{.899}{G} \right)$$

$T_m$  is the merge time (see Table 4).

The merge order ( $M_d$ ) for the memory-to-disk merge =  $\lceil \sqrt[3]{G} \rceil$

$T_5$  will be the disk work time or the memory-to-disk merge time, whichever is greater.

*Calculation of the Total Phase 1 Sorting Time ( $T_1$ ):*

$$T_1 = T_1 + T_2 + T_3 + T_4 + T_5$$

#### 1410-1301 Timing: Phase 2 Time ( $T_{II}$ ) Calculation Formulas

The total Phase 2 sorting time for a 1410-1301 configuration consists of:

1. The input time less the amount of overlap time.
2. The input iocs time.
3. The process time or the output time, whichever is greater.
4. The look-ahead time.
5. The output iocs time.
6. The seek time that cannot be overlapped.

*Input Time Minus Overlapped Read Time ( $T_1$ ):* The formula for the input time ( $T_1$ ) is derived as follows:

$$T_1 = \frac{\text{Avg. rotational delay} + \text{maximum read time}}{B} - T_d$$

$$T_1 = \frac{17 + 34}{B} - T_d$$

$$T_1 = \frac{51}{B} - T_d$$

The calculation of the overlapped read time ( $T_d$ ) is described below.

*Input IOCS Time ( $T_2$ ):*

$$T_2 = \frac{9.8}{B}$$

*Process Time or Output Time ( $T_3$ ):*

The process time ( $T_p$ ) =

$$T_m + .416 + .016M_2 + .01125L + \frac{1.477}{B} + .448 + .0045L$$

The merge time ( $T_m$ ) for an 8-way merge =  
1.027 + .27CW

The merge time ( $T_m$ ) for a 12-way merge =  
1.263 + .33CW

$$\text{The output time } (T_o) = \frac{51}{B}$$

$T_3$  is the process time or the output time, whichever is greater.

*Look-ahead Time ( $T_4$ ):*

$$T_4 = \frac{1.193 + .009CW}{B}$$

*Output IOCS Time ( $T_5$ ):*

$$T_5 = \frac{8.1}{B}$$

*Seek Time That Cannot Be Overlapped ( $T_6$ ):*

$$T_6 = \frac{1}{B [M_2(B-1) + 1]} \left( \frac{R^2}{T_3} \right) \left( \frac{M_2B - M_2}{2B} \right)$$

The average seek time ( $R$ ) in Phase 2 can be found in Table 5.

*Calculation of the Overlapped Read Time ( $T_d$ ):* If the output time ( $T_o$ ) is greater than the process time ( $T_p$ ) (i.e., the system is I/O bound), then the overlapped read time ( $T_d$ ) = 0. If  $T_o$  is smaller than  $T_p$  (i.e., the system is process bound), then  $T_d$  is the smaller of:

$$\frac{1}{M} \left( \frac{51}{B} \right)$$

or

$$T_p - T_o$$

*Calculation of the Total Phase 2 Sorting Time ( $T_{II}$ ):*

The total Phase 2 sorting time ( $T_{II}$ ) =

$$P(T_1 + T_2 + T_3 + T_4 + T_5) + T_{6PASS1} + T_{6PASS2} \dots$$

#### 1410-1301 Timing: Phase 3 Time ( $T_{III}$ ) Calculation Formulas

The total Phase 3 sorting time for a 1410-1301 configuration consists of:

1. The input time less the amount of overlap time.
2. The input iocs process time.
3. The output time or process time, whichever is greater.
4. The look ahead time.
5. The output iocs time.
6. The seek time that cannot be overlapped.

*Input Time Minus Overlapped Read Time ( $T_1$ ):*

$$T_1 = \frac{51}{B} - T_d$$

The overlapped read time ( $T_d$ ) is calculated as in Phase 2.

*Input IOCS Process Time ( $T_2$ ):*

$$T_2 = \frac{9.8}{B}$$

*Output Time or Process Time ( $T_3$ ):*

$$\begin{aligned} \text{The process time } (T_p) = & T_m + \frac{(.271 + .009CW)}{M_3} \\ & + .416 + .016M_3 + .01125L \\ & + \frac{1.477}{B} + .448 + .0045L \end{aligned}$$

See Table 2 for the value of  $M_3$ .

See Table 4 for the merge time ( $T_m$ ).

$$\text{The output time } (T_o) = \frac{51}{B}$$

$T_3$  will be the process time or the output time, whichever is greater.

*Look Ahead Time ( $T_4$ ):*

$$T_4 = \frac{1.193 + .009CW}{B}$$

*Output IOCS Time ( $T_5$ ):*

$$T_5 = \frac{8.1}{B_o}$$

*Seek Time That Cannot Be Overlapped ( $T_6$ ):*

$$T_6 = \frac{1}{B[M_3(B-1) + 1]} \left( \frac{R^2}{2T_3} \right) \left( \frac{M_3B - M_3}{2B} \right)$$

The average seek time ( $R$ ) in Phase 3 can be found in Table 5.

*Calculation of the Total Phase 3 Sorting Time ( $T_{III}$ ):*

$$\text{The total Phase 3 sorting time } (T_{III}) = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$$

#### 7010-1301 Timing: Phase 1 Time ( $T_I$ ) Calculation Formulas

The sorting times for Phases 1, 2, and 3 in a 7010-1301 configuration consists of the same factors described in the 1410-1301 sort timing section. In cases where a formula itself remains the same for the 7010-1301, the reader is referred to the 1410-1301 formula.

*Tape Read Time or Binary Insertion Time ( $T_1$ ):* The tape read time formula is the same as the one used for the 1410-1301 Phase 1 time calculation.

$$\begin{aligned} \text{The binary insertion time} = & C (.0702 + .003CW) \\ & + \frac{1.01}{BIO} + \frac{17.42}{G} + .650 \\ & + \frac{.184}{B} + .0012L \end{aligned}$$

$T_1$  will be the tape read time or the binary insertion time, whichever is greater.

*Input IOCS Time ( $T_2$ ):*

$$T_2 = \frac{1.5}{B}$$

*Memory-to-Memory Merge Time ( $T_3$ ):*

$$T_3 = T_m + .168 + M_m \left( .0052 + \frac{.290}{G} \right) + .160$$

The merge time ( $T_m$ ) can be found in Table 6.

The merge order ( $M_m$ ) for the memory-to-memory merge =  $\lceil \sqrt[3]{G} \rceil$

*Output IOCS Time ( $T_4$ ):*

$$T_4 = \frac{3.3}{B}$$

*Disk Write Time or Memory-to-Disk Merge Time ( $T_5$ ):*

$$\text{The disk write time} = \frac{68}{B}$$

The memory-to-disk merge time =

$$T_m + \frac{1.026}{B} + .280 + .0052L + M_d \left( .0052 + \frac{.290}{G} \right)$$

The merge time ( $T_m$ ) can be found in Table 6.

The merge order ( $M_d$ ) for the memory-to-disk merge =  $\lceil \sqrt[3]{G} \rceil$

$T_5$  is the disk write time or memory-to-disk merge time, whichever is greater.

*Calculation of the Phase 1 Sorting Time:*

$$T_I = T_1 + T_2 + T_3 + T_4 + T_5$$

**7010-1301 Timing: Phase 2 Time ( $T_{II}$ ) Calculation Formulas**

*Input Time Minus Overlapped Read Time ( $T_1$ ):*

$$T_1 = \frac{\text{Maximum rotational delay} + \text{read time}}{B} - T_d$$

$$T_1 = \frac{34 + 34}{B} - T_d$$

$$T_1 = \frac{68}{B} - T_d$$

The calculation of the overlapped read time ( $T_d$ ) is the same as described in the 1410-1301 section.

*Input IOCS Time ( $T_2$ ):*

$$T_2 = \frac{3.5}{B}$$

*Process Time or Output Time ( $T_3$ ):*

$$\begin{aligned} \text{The process time } (T_p) &= T_m + .134 + .0052M_2 \\ &+ .0028L + \frac{.476}{B} + .145 + .0012L \end{aligned}$$

$$\text{The merge time } (T_m) \text{ for an 8-way merge} = .340 + .09CW$$

$$\text{The merge time } (T_m) \text{ for a 12-way merge} = .414 + .11CW$$

$$\text{The output time } (T_o) = \frac{68}{B}$$

$T_3$  is the process time or the output time, whichever is greater.

*Look-Ahead Time ( $T_4$ ):*

$$T_4 = \frac{.385 + .003CW}{B}$$

*Output IOCS Time ( $T_5$ ):*

$$T_5 = \frac{3.3}{B}$$

*Seek Time That Cannot Be Overlapped ( $T_6$ ):* This formula is the same as the one given for 1410-1301 timing.

*Calculation of the Total Phase 2 Sorting Time ( $T_{II}$ ):*

$$\begin{aligned} T_{II} &= P(T_1 + T_2 + T_3 + T_4 + T_5) + T_{6PASS1} \\ &+ T_{6PASS2} \dots \end{aligned}$$

**7010-1301 Timing: Phase 3 Time ( $T_{III}$ ) Calculation Formulas**

*Input Time Minus Overlapped Read Time ( $T_1$ ):*

$$T_1 = \frac{68}{B} - T_d$$

The calculation of the overlapped read time ( $T_d$ ) is described in the 1410-1301 section.

*Input IOCS Time ( $T_2$ ):*

$$T_2 = \frac{3.5}{B}$$

*Output Time or Process Time ( $T_3$ ):*

The process time ( $T_p$ ) =

$$\begin{aligned} T_m + \frac{(.087 + .003CW)}{M_3} + .349 + .0052M_3 + .0058L \\ + \frac{.670}{B} + .0012L \end{aligned}$$

The merge time ( $T_m$ ) can be found in Table 6.

$$\text{The output time } (T_o) = \frac{51}{B}$$

$T_3$  will be the process time or the output time, whichever is greater.

*Look Ahead Time ( $T_4$ ):*

$$T_4 = \frac{3 + .003CW}{B}$$

The 7010-1301 timing calculations for the output iocs time ( $T_5$ ), the seek time that cannot be overlapped ( $T_6$ ), and the total Phase 3 sorting time ( $T_{III}$ ) are the same as described in the 1410-1301 section.

**1410-2302 Timing: Phase 1 Time ( $T_I$ ) Calculation Formulas**

The sorting times for Phases 1, 2 and 3 in a 1410-2302 configuration consist of the same factors described in the 1410-1301 timing section. All the formulas used in the 1410-2302 calculations are the same as those listed for the 1410-1301, with the following exceptions:

*Disk Write Time Plus Disk Merge Time ( $T_5$ ):* For the 1410-2302,  $T_5$  is the sum of the disk write time and the disk merge time. This is because the high-speed input/output of the 2302 precludes the overlapping of output and processing. The disk write time =  $\frac{34}{B}$ . The

disk merge time is calculated in the same way as for the 1410-1301.

**1410-2302 Timing: Phase 2 Time ( $T_{II}$ ) Calculation Formulas**

*Input Time ( $T_1$ ):* For the 1410-2302,

$$T_1 = \frac{34}{B}$$

*Process Time Plus Output Time ( $T_5$ ):* The process time ( $T_p$ ) for a 1410-2302 configuration =

$$T_m = 1.263 + .01125L \\ + \frac{1.477}{B} + .488.$$

In the foregoing formula, the merge time ( $T_m$ ) for an 8-way merge =  $1.027 + .27CW$ . For a 12-way merge,  $T_m = 1.263 + .33CW$ .

$$\text{The output time } (T_0) = \frac{34}{B}$$

$$T_3 = T_p + T_0$$

*Seek Time That Cannot Be Overlapped ( $T_6$ ):* This calculation is the same as the one for the 1410-1301, except that the value for 8 (average seek time) in Phase 2 must be obtained from Table 7.

**1410-2302 Timing: Phase 3 Time ( $T_{III}$ ) Calculation Formulas**

*Input Time ( $T_1$ ):*

$$T_1 = \frac{34}{B}$$

*Seek Time that Cannot be Overlapped ( $T_6$ ):* This calculation is the same as the one for the 1410-1301, except that the value for R (average seek time) in Phase 3 must be obtained from Table 7.

**7010-2302 Timing: Phase 1 Time ( $T_I$ ) Calculation Formulas**

The sorting times for Phases 1, 2, and 3 in a 7010-2302 configuration consist of the same factors described in the 7010-1301 section. All the formulas used in the 7010-2302 calculations are the same as those listed for the 7010-1301, with the following exceptions:

*Disk Write Time or Memory-To-Disk Merge Time ( $T_5$ ):*

$$\text{The disk write time} = \frac{51}{B}$$

The remainder of the calculation is performed in the same way as described in the 7010-1301 section.

**7010-2302 Timing: Phase 2 Time ( $T_{II}$ ) Calculation Formulas**

*Input Time Less Overlap ( $T_1$ ):*

$$T_1 = \frac{51}{B} - T_d$$

The calculation for the overlapped read time ( $T_d$ ) is described in the 1410-1301 section.

*Process Time or Output Time ( $T_5$ ):*

$$\text{The output time } (T_0) = \frac{51}{B}$$

The rest of the calculation is the same as described in the 7010-1301 section.

*Seek Time That Cannot Be Overlapped ( $T_6$ ):* This calculation is the same as described in the 1410-1301 section, except that Table 7 should be consulted to obtain the value for R.

**7010-2302 Timing: Phase 3 Time ( $T_{III}$ ) Calculation Formulas**

*Input Time Less Overlap ( $T_1$ ):*

$$T_1 = \frac{51}{B} - T_d$$

The calculation for the overlapped read time ( $T_d$ ) is described in the 1410-1301 section.

*Seek Time That Cannot Be Overlapped ( $T_6$ ):* This calculation is the same as described in the 1410-1301 section, except that Table 7 should be consulted to obtain the value for R.

**Calculation of the Total Sorting Time  $T_I + T_{II} + T_{III}$** 

The total sorting time in milliseconds per record is the sum of the sorting times calculated for Phases 1, 2, and 3.

**Calculation of the Number of Cylinders Required for Disk Work Space**

The formulas provided in this section will enable the user to estimate the number of cylinders required by his application for each of the two disk work areas. If the characteristics of the user's data file are covered by the timing tables, he can obtain the cylinder-requirement information from the tables themselves.

The following steps should be taken to calculate the work area cylinder requirements (if the user has already performed the timing calculations, the results of steps 1, 2, and 3 have already been obtained):

1. Calculate the sort blocking factor (B).
2. Calculate the number of records that can be internally sorted at one time (G).
3. Calculate the number of sequences produced by Phase 1.
4. Calculate the number of tracks required in disk work area A and disk work area B for the output of Phase 1.
5. Calculate the total number of tracks required for disk work area A, based on the number of passes required in Phase 2.
6. Convert the number of tracks required for each disk work area to cylinders.

**Calculation of the Sort Blocking Factor (B)**

$$B = \left\lfloor \frac{2800}{L} \right\rfloor$$

B is also the number of records per track on input to and output from Phase 2.

### Calculation of the Number of Records that Can Be Internally Sorted at One Time (G)

If a machine with 60,000 positions of core storage is used,

$$G = 5B$$

If a machine with 80,000 or 100,000 positions of core storage is used,

$$G = 10B$$

### Calculation of the Number of Sequences Produced by Phase 1 (S<sub>1</sub>)

$$S_1 = \left\lceil \frac{N}{G} \right\rceil$$

### Calculation of the Number of Tracks Required for Phase 1 Output

Since the output from Phase 1 is distributed on disk work space A and disk work space B, the following formulas should be used:

If a machine with 60,000 positions of core storage is used,

$$\begin{aligned} H_A' &= \left\lceil 5 \frac{S_1}{2} \right\rceil \\ H_B &= \left\lceil 5 \frac{S_1}{2} \right\rceil \end{aligned}$$

If a machine with 80,000 or 100,000 positions of core storage is used,

$$\begin{aligned} H_A' &= \left\lceil 10 \frac{S_1}{2} \right\rceil \\ H_B &= \left\lceil 10 \frac{S_1}{2} \right\rceil \end{aligned}$$

where  $H_A$  is the number of tracks used in disk work area A for the output of Phase 1, and  $H_B$  is the number of tracks used in disk work area B for the output of Phase 1.

### Calculation of the Total Number of Tracks Required for Work Area A

This calculation is based on the number of passes required in Phase 2. The number of passes required can be determined by consulting Table 1.

If less than one full Phase 2 pass is required, or if Phase 2 is to be reloaded,

$$H_A = 2H_A'$$

If exactly one full Phase 2 pass is required, and a machine with 60,000 positions of core storage is used,

$$H_A = H_A' + 5M_2$$

If exactly one full Phase 2 pass is required, and a machine with 80,000 or 100,000 positions of core storage is used,

$$H_A = H_A' + 10M_2^2$$

If more than one full Phase 2 pass is required, and a machine with 60,000 positions of core storage is used,

$$H_A = H_A' + 5M_2^2$$

If more than one full Phase 2 pass is required, and a machine with 80,000 to 100,000 positions of core storage is used,

$$H_A = H_A' + 10M_2^2$$

In the above formulas,  $H_A$  is the total number of tracks required for disk work area A, and  $M_2$  is the maximum Phase 2 merge order (8 if a 60K machine is used, 12 if an 80K or 100K machine is used).

### Conversion of the Track Calculations to Cylinders

$$CYL_A = \left\lceil \frac{H_A}{40} \right\rceil$$

$$CYL_B = \left\lceil \frac{H_B}{40} \right\rceil$$

where  $CYL_A$  is the number of cylinders in disk work area A, and  $CYL_B$  is the number of cylinders in disk work area B ( $H_B$  is obtained in step 4).

### Example of the Cylinder Calculation

Assume that the user has a machine with 100,000 positions of core storage, and that his input file contains 10,000 eighty-character records. The sort will process the records in that 80-character form.

The application of the cylinder-calculation formulas would be as follows:

$$(1) B = \left\lceil \frac{2800}{L} \right\rceil, B = \frac{2800}{80}, B = 35$$

$$(2) G = 10B, G = 350$$

$$(3) S_1 = \left\lceil \frac{N}{G} \right\rceil, S_1 = 29$$

$$\begin{aligned} (4) H_A' &= \left\lceil 10 \frac{S_1}{2} \right\rceil, H_A' = 10 (14.5), H_A' = 145 \\ H_B &= \left\lceil 10 \frac{S_1}{2} \right\rceil, H_B = 10 (14.5), H_B = 145 \end{aligned}$$

(5) Table 1 shows that less than one full pass is required in Phase 2. (For 100K machines, 144 sequences would require a full Phase 2 pass.) Therefore,

$$H_A = 2H_A', H_A = 290 \text{ tracks}$$

$$(6) CYL_A = \left\lceil \frac{H_A}{40} \right\rceil, CYL_A = \frac{290}{40}, CYL_A = 8$$

$$\begin{aligned} \text{From (4), } H_B &= 140, CYL_B = \left\lceil \frac{H_B}{40} \right\rceil, CYL_B \\ &= \frac{145}{40}, CYL_B = 4 \end{aligned}$$

Eight cylinders are required for work space A.  
Four cylinders are required for work space B.

## Tables

Table 1. Number of Phase 2 Passes per Number of Sequences

	Number of Sequences from Phase 1 $(S = \frac{[N]}{G})$	Number of Passes Required in Phase 2
8-Way Merge (Machines With 60,000 Partitions of Core Storage)	1-8	0
	9-64	1
	65-512	2
	513-4,096	3
12-Way Merge (Machines With 80,000 to 100,000 Partitions of Core Storage)	1-12	0
	13-144	1
	145-1,728	2

Table 2. Phase 3 Merge Order

	Number of Sequences from Phase 1	Merge Order*
Up to an 8-Way Merge (Machines with 60,000 Partitions of Core Storage)	9-64	3 8
	65-512	3 64
	513-4,096	5 512
		5
Up to a 12-Way Merge (Machines with 80,000 to 100,000 Partitions of Core Storage)	13-144	5 12
	145-1,728	5 144
		5

\* Calculated to the nearest even integer

Table 3. Number of Compares per Binary Insertion Order

Binary Insertion Order	C
2	.5
3	1.0
4	1.25
5	1.5
6	1.7
7	1.9
8	2.1
9	2.2
10	2.3
11	2.5
12	2.6

Table 4. 1410 Merge Time

Merge Order	Merge Time
12	1,263 + .0330CW
11	1,239 + .0319CW
10	1,194 + .0306CW
9	1,100 + .0300CW
8	1,027 + .0270CW
7	.968 + .0257CW
6	.903 + .0240CW
5	.796 + .0216CW
4	.672 + .0180CW
3	.581 + .0150CW
2	.350 + .0090CW

Table 5. Average Seek Time (R) in Milliseconds per Record for 1301 Disk Storage

Pass	Phase 2		Phase 3						
	60K Machines	80/100K Machines	60K Machines			80/100K Machines			
			M3=1,2	M3=3,4	M3=5-8	M3=1,2	M3=3,4	M3=5-8	M3=9-12
0	0.0	0.0	0.0	0.0	0.0	0.0	6.3*	12.5	25.0
1	0.0	41.0	0.0	8.6	17.2	0.0	19.3	38.7	77.3
2	68.5	115.1	0.0	17.8	35.7	0.0	35.5	71.9	143.8
3	127.3	----	0.0	28.9	57.9	----	----	----	----

Table 6. 7010 Merge Time

Merge Order	Merge Time
12	.414 + .0110CW
11	.403 + .0107CW
10	.373 + .0102CW
9	.359 + .0096CW
8	.340 + .0090CW
7	.310 + .0087CW
6	.293 + .0080CW
5	.266 + .0070CW
4	.224 + .0060CW
3	.193 + .0050CW
2	.120 + .0030CW

Table 7. Average Seek Time (R) in Milliseconds per Record for 2302 Disk Storage

Pass	Phase 2		Phase 3						
	60K Machines	80/100K Machines	60K Machines			80/100K Machines			
			M3=1,2	M3=3,4	M3=5-8	M3=1,2	M3=3,4	M3=5-8	M3=9-12
0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	11.1	22.2
1	0.0	44.3	0.0	9.4	18.8	0.0	18.9	37.7	75.4
2	63.5	101.9	0.0	16.4	32.8	0.0	33.3	66.6	133.2
3	129.8	----	0.0	30.0	60.0	----	----	----	----



## Timing Tables

### General Information

The timing tables included in this section will enable the 1410/7010 Operating System user to make estimates, for planning purposes, of the time required for the running of a sort program produced from the Generalized Disk Sorting Program. The tables include timing estimates for both 1410 and 7010 systems using 1301 or 2302 Disk Storage for work space and 729 iv or 7330 magnetic tape units for input and output. Users of disk storage for input and/or output can also obtain timing approximations from the tables (see below).

The column headings and their meanings are as follows:

COLUMN HEADING	MEANING
FILE SIZE	The number of data records, in thousands, to be stored. <sup>sorted</sup>
CW LNG	The length of the control data field.
CYL. USED MOD MOD A B	The amount of disk storage, in cylinders, required by the sorting program for work space. Figures are given for each of two modules of disk storage (see item 5, below).
SORTING TIME IN MINUTES PHASE PHASE PHASE TOTAL 1 2 3 TIME	The time, in minutes and tenths of a minute, for each phase of the sort, and the total running time.

The values given in the tables are based on the following assumptions:

1. The size of the Resident Monitor is 20,000 posi-

tions of core storage, and no core storage is used in any phase for added programming.

2. The data records are of fixed length. The user can approximate the sorting time for an application using variable-length data records by taking the table value for the maximum data record length, and adding to it a value equal to the total time required to move each data record once.

3. A single control data field is specified. For most sorting applications involving multiple control data fields, the user can obtain an approximation of the total sorting time by considering the sum of his control data field lengths as the actual control data field length, and using the tables accordingly.

4. The input and output blocking factors are equal to the sort blocking factor. The sort blocking factor is equal to the integer value (whole number) of  $\frac{2,800}{L}$ , where L is the length of the data record. (For variable-length records, L is the length of the longest data record.)

5. Two modules of disk storage, both on one channel, are available to the sorting program for work space. The tables apply for 2302 disk storage, if the two arms of one module are each used as arms for separate modules.

6. Magnetic tape units are used for the input and output files, and the density of the tape is 556 characters per inch. When a module of disk storage (in addition to the modules used for work space) is used for the input and/or output files, the sorting times will be approximately the same as those given for the 729 iv tape units.

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	1	1	.6	.0	.3	.9	1	1	.7	.0	.2	.9
	10			.7	.0	.3	.9			.7	.0	.2	.9
	15			.7	.0	.3	1.0			.8	.0	.3	1.0
10	5	2	1	1.3	.5	.4	2.2	1	1	1.4	.0	.6	1.9
	10			1.4	.5	.4	2.3			1.4	.0	.6	2.0
	15			1.4	.5	.4	2.4			1.5	.0	.6	2.1
20	5	3	2	2.6	1.0	.9	4.5	4	2	2.7	1.1	.8	4.6
	10			2.7	1.0	1.0	4.7			2.9	1.2	.8	4.9
	15			2.8	1.1	1.0	4.9			3.0	1.2	.9	5.1
30	5	4	3	3.9	1.5	1.6	6.9	6	3	4.1	1.6	1.2	7.0
	10			4.1	1.5	1.6	7.2			4.3	1.7	1.2	7.3
	15			4.3	1.6	1.7	7.6			4.5	1.8	1.3	7.6
40	5	5	4	5.2	2.0	2.2	9.3	7	4	5.5	2.2	1.9	9.5
	10			5.4	2.0	2.3	9.8			5.7	2.3	2.0	10.0
	15			5.7	2.1	2.4	10.2			6.0	2.4	2.0	10.5
50	5	13	5	6.5	4.9	2.0	13.4	8	5	6.8	2.7	2.4	11.9
	10			6.8	5.1	2.1	14.0			7.2	2.9	2.5	12.5
	15			7.1	5.4	2.1	14.6			7.5	3.0	2.5	13.1
75	5	15	7	9.7	7.4	3.0	20.1	10	7	10.2	4.1	3.9	18.3
	10			10.2	7.7	3.1	21.0			10.8	4.3	4.1	19.2
	15			10.7	8.0	3.2	21.9			11.3	4.5	4.3	20.1
100	5	17	9	12.9	9.8	4.7	27.5	12	9	13.6	5.5	5.2	24.4
	10			13.6	10.3	4.9	28.8			14.4	5.8	5.5	25.6
	15			14.2	10.7	5.1	30.0			15.1	6.0	5.7	26.8
125	5	20	12	16.2	12.3	5.9	34.4	15	12	17.1	6.9	6.9	30.8
	10			17.0	12.9	6.1	35.9			18.0	7.2	7.2	32.4
	15			17.8	13.4	6.3	37.5			18.9	7.5	7.5	33.9
150	5	22	14	19.4	14.7	7.1	41.2	17	14	20.5	8.2	8.9	37.6
	10			20.4	15.4	7.4	43.1			21.6	8.6	9.3	39.5
	15			21.3	16.1	7.6	45.0			22.6	9.1	9.7	41.4
175	5	24	16	22.6	17.2	8.3	48.1	19	16	23.9	9.6	10.4	43.8
	10			23.7	18.0	8.6	50.3			25.1	10.1	10.9	46.1
	15			24.9	18.8	8.9	52.5			26.4	10.6	11.3	48.3
200	5	26	18	25.9	19.7	10.5	56.0	21	18	27.3	11.0	11.9	50.1
	10			27.1	20.6	10.9	58.6			28.7	11.5	12.4	52.7
	15			28.4	21.5	11.3	61.2			30.2	12.1	13.0	55.2
250	5	31	23	32.3	24.6	13.1	70.0	59	23	34.1	27.6	10.1	71.9
	10			33.9	25.7	13.6	73.3			35.9	29.0	10.4	75.3
	15			35.5	26.8	14.2	76.5			37.7	30.4	10.7	78.8
300	5	35	27	38.8	29.5	16.6	84.9	63	27	40.9	33.2	12.1	86.2
	10			40.7	30.8	17.3	88.8			43.1	34.8	12.5	90.4
	15			42.6	32.2	18.0	92.8			45.3	36.4	12.8	94.5
350	5	40	32	45.3	34.4	19.3	99.0	68	32	47.8	38.7	14.1	100.6
	10			47.5	36.0	20.2	103.6			50.3	40.6	14.5	105.4
	15			49.7	37.6	21.0	108.3			52.8	42.5	14.9	110.3
400	5	72	36	51.7	59.5	16.2	127.4	72	36	54.6	44.2	16.2	115.0
	10			54.3	62.1	16.6	133.0			57.5	46.4	16.6	120.5
	15			56.8	64.8	17.1	138.7			60.4	48.6	17.1	126.0

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.2	1.2	1	1	.7	.0	.3	.9
	10			.7	.3	.2	1.2			.7	.0	.3	1.0
	15			.7	.3	.2	1.3			.8	.0	.3	1.0
	20			.8	.3	.3	1.3			.8	.0	.3	1.1
10	5	3	2	1.4	.6	.5	2.5	2	1	1.4	.0	.7	2.0
	10			1.4	.6	.6	2.6			1.4	.0	.7	2.1
	15			1.5	.6	.6	2.7			1.5	.0	.7	2.2
	20			1.5	.6	.6	2.8			1.6	.0	.8	2.3
20	5	4	3	2.7	1.1	1.2	5.0	6	3	2.7	1.2	.9	4.9
	10			2.8	1.2	1.2	5.2			2.9	1.3	1.0	5.1
	15			3.0	1.2	1.3	5.4			3.0	1.3	1.0	5.3
	20			3.1	1.2	1.3	5.7			3.1	1.4	1.0	5.5
30	5	13	5	4.1	3.4	1.4	8.8	8	5	4.1	1.9	1.6	7.6
	10			4.3	3.5	1.4	9.2			4.3	1.9	1.7	7.9
	15			4.4	3.6	1.5	9.5			4.5	2.0	1.7	8.3
	20			4.6	3.8	1.5	9.9			4.7	2.1	1.8	8.6
40	5	14	6	5.4	4.5	1.9	11.8	9	6	5.5	2.5	2.2	10.1
	10			5.7	4.7	1.9	12.3			5.7	2.6	2.3	10.6
	15			5.9	4.8	2.0	12.7			6.0	2.7	2.3	11.0
	20			6.2	5.0	2.0	13.2			6.3	2.8	2.4	11.5
50	5	15	7	6.8	5.6	2.3	14.7	10	7	6.8	3.1	3.0	12.9
	10			7.1	5.8	2.4	15.3			7.2	3.2	3.1	13.5
	15			7.4	6.0	2.5	15.9			7.5	3.4	3.2	14.1
	20			7.7	6.3	2.5	16.5			7.8	3.5	3.3	14.7
75	5	19	11	10.2	8.4	4.1	22.7	14	11	10.2	4.6	4.7	19.6
	10			10.7	8.7	4.2	23.6			10.7	4.8	4.9	20.5
	15			11.1	9.1	4.3	24.5			11.3	5.0	5.1	21.4
	20			11.6	9.4	4.5	25.5			11.8	5.2	5.3	22.3
100	5	22	14	13.6	11.2	5.5	30.3	17	14	13.7	6.2	6.7	26.6
	10			14.2	11.6	5.6	31.5			14.3	6.4	7.0	27.8
	15			14.8	12.1	5.8	32.7			15.0	6.7	7.3	29.0
	20			15.4	12.5	6.0	33.9			15.7	7.0	7.6	30.2
125	5	25	17	17.0	14.0	7.5	38.5	20	17	17.1	7.7	8.4	33.2
	10			17.8	14.6	7.8	40.1			17.9	8.1	8.8	34.7
	15			18.5	15.1	8.0	41.7			18.8	8.4	9.1	36.3
	20			19.3	15.7	8.3	43.3			19.6	8.7	9.5	37.8
150	5	29	21	20.4	16.8	9.0	46.2	57	21	20.5	18.8	7.0	46.3
	10			21.3	17.5	9.3	48.1			21.5	19.6	7.2	48.3
	15			22.2	18.1	9.6	50.0			22.5	20.4	7.4	50.3
	20			23.2	18.8	10.0	51.9			23.5	21.2	7.5	52.3
175	5	32	24	23.8	19.6	10.5	53.9	60	24	23.9	21.9	8.2	54.0
	10			24.9	20.4	10.9	56.1			25.1	22.9	8.4	56.3
	15			26.0	21.2	11.2	58.4			26.3	23.8	8.6	58.7
	20			27.0	21.9	11.6	60.6			27.4	24.8	8.8	61.0
200	5	35	27	27.2	22.4	12.6	62.2	63	27	27.3	25.1	9.4	61.7
	10			28.4	23.3	13.1	64.8			28.7	26.1	9.6	64.4
	15			29.7	24.2	13.5	67.4			30.0	27.2	9.8	67.0
	20			30.9	25.1	14.0	70.0			31.4	28.3	10.0	69.7
250	5	68	34	34.0	42.6	11.7	88.3	70	34	34.1	31.3	11.7	77.1
	10			35.6	44.3	12.0	91.8			35.8	32.7	12.0	80.5
	15			37.1	45.9	12.3	95.2			37.5	34.0	12.3	83.8
	20			38.6	47.6	12.5	98.7			39.2	35.4	12.5	87.1
300	5	82	41	40.9	51.1	14.0	106.0	77	41	41.0	37.6	16.6	95.1
	10			42.7	53.1	14.4	110.1			43.0	39.2	17.1	99.3
	15			44.5	55.1	14.7	114.3			45.0	40.8	17.6	103.4
	20			46.3	57.1	15.1	118.4			47.0	42.4	18.1	107.6
350	5	96	48	47.7	59.6	16.4	123.7	84	48	47.8	43.8	19.4	111.0
	10			49.8	62.0	16.8	128.5			50.2	45.7	19.9	115.8
	15			51.9	64.3	17.2	133.3			52.5	47.6	20.5	120.7
	20			54.0	66.6	17.6	138.2			54.9	49.5	21.1	125.5
400	5	108	54	54.5	68.2	18.7	141.3	90	54	54.6	50.1	22.1	126.8
	10			56.9	70.8	19.2	146.9			57.3	52.3	22.8	132.4
	15			59.3	73.4	19.6	152.4			60.0	54.4	23.5	137.9
	20			61.8	76.1	20.1	157.9			62.7	56.6	24.1	143.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.3	1.3	1	1	.7	.0	.4	1.0
	10			.7	.3	.3	1.3			.7	.0	.4	1.0
	15			.8	.3	.3	1.4			.8	.0	.4	1.1
	20			.8	.3	.3	1.4			.8	.0	.4	1.1
10	5	3	2	1.4	.6	.6	2.6	4	2	1.4	.7	.6	2.6
	10			1.5	.6	.6	2.7			1.4	.7	.6	2.7
	15			1.5	.7	.6	2.8			1.5	.7	.6	2.8
	20			1.6	.7	.7	2.9			1.6	.8	.6	2.9
20	5	5	4	2.8	1.2	1.4	5.4	7	4	2.8	1.4	1.2	5.4
	10			2.9	1.3	1.4	5.6			2.9	1.4	1.3	5.6
	15			3.0	1.3	1.5	5.9			3.0	1.5	1.3	5.8
	20			3.1	1.4	1.5	6.1			3.2	1.5	1.3	6.0
30	5	14	6	4.2	3.8	1.7	9.6	9	6	4.2	2.1	1.9	8.1
	10			4.4	3.9	1.7	9.9			4.3	2.1	1.9	8.4
	15			4.5	4.0	1.7	10.3			4.5	2.2	2.0	8.7
	20			4.7	4.2	1.7	10.6			4.7	2.3	2.0	9.0
40	5	16	8	5.6	5.0	2.2	12.8	11	8	5.5	2.7	2.7	11.0
	10			5.8	5.2	2.2	13.3			5.8	2.8	2.8	11.4
	15			6.1	5.4	2.2	13.7			6.1	3.0	2.9	11.9
	20			6.3	5.6	2.3	14.1			6.3	3.1	3.0	12.3
50	5	17	9	7.0	6.3	3.1	16.4	12	9	6.9	3.4	3.4	13.7
	10			7.3	6.5	3.2	17.0			7.2	3.6	3.5	14.3
	15			7.6	6.7	3.3	17.6			7.6	3.7	3.6	14.9
	20			7.9	6.9	3.3	18.2			7.9	3.8	3.7	15.4
75	5	22	14	10.5	9.4	4.6	24.5	17	14	10.4	5.1	5.6	21.2
	10			10.9	9.7	4.8	25.4			10.9	5.3	5.9	22.1
	15			11.4	10.1	4.9	26.3			11.3	5.5	6.1	23.0
	20			11.8	10.4	5.0	27.2			11.8	5.8	6.3	23.9
100	5	26	18	14.0	12.5	6.8	33.3	21	18	13.9	6.8	7.5	28.2
	10			14.6	13.0	7.0	34.5			14.5	7.1	7.8	29.4
	15			15.1	13.4	7.2	35.8			15.1	7.4	8.1	30.6
	20			15.7	13.9	7.4	37.0			15.8	7.7	8.4	31.8
125	5	31	23	17.5	15.7	8.4	41.6	59	23	17.3	17.5	7.0	41.8
	10			18.2	16.2	8.7	43.2			18.1	18.2	7.0	43.3
	15			18.9	16.8	9.0	44.7			18.9	18.8	7.0	44.7
	20			19.7	17.4	9.2	46.3			19.7	19.5	7.1	46.3
150	5	35	27	21.0	18.8	10.6	50.4	63	27	20.8	21.0	8.4	50.2
	10			21.8	19.5	10.9	52.3			21.7	21.8	8.4	51.9
	15			22.7	20.2	11.3	54.2			22.7	22.6	8.4	53.7
	20			23.6	20.8	11.7	56.1			23.6	23.4	8.5	55.5
175	5	40	32	24.5	22.0	12.4	58.8	68	32	24.2	24.5	9.8	58.5
	10			25.5	22.7	12.8	61.0			25.4	25.5	9.8	60.6
	15			26.5	23.5	13.2	63.2			26.5	26.4	9.8	62.6
	20			27.5	24.3	13.6	65.4			27.6	27.3	9.9	64.8
200	5	72	36	28.0	38.5	11.2	77.6	72	36	27.7	28.0	11.2	66.9
	10			29.1	39.8	11.2	80.1			29.0	29.1	11.2	69.2
	15			30.3	41.1	11.2	82.6			30.3	30.2	11.2	71.6
	20			31.5	42.4	11.3	85.1			31.5	31.2	11.3	74.0
250	5	90	45	35.0	48.1	14.0	97.0	81	45	34.6	35.0	15.7	85.4
	10			36.4	49.7	14.0	100.1			36.2	36.4	16.1	88.7
	15			37.9	51.4	14.0	103.2			37.8	37.7	16.6	92.1
	20			39.3	53.0	14.1	106.4			39.4	39.0	17.0	95.4
300	5	108	54	41.9	57.7	16.8	116.4	90	54	41.6	42.0	18.9	102.4
	10			43.7	59.7	16.8	120.1			43.5	43.6	19.4	106.5
	15			45.4	61.6	16.8	123.8			45.4	45.2	19.9	110.5
	20			47.2	63.6	16.9	127.7			47.3	46.8	20.4	114.5
350	5	126	63	48.9	67.3	19.6	135.8	99	63	48.5	49.0	22.0	119.5
	10			51.0	69.6	19.6	140.2			50.7	50.9	22.6	124.2
	15			53.0	71.9	19.6	144.5			52.9	52.8	23.2	128.9
	20			55.0	74.2	19.8	149.0			55.2	54.6	23.8	133.6
400	5	136	72	55.9	77.0	24.9	157.8	108	72	55.4	56.0	25.2	136.6
	10			58.3	79.6	25.6	163.4			58.0	58.2	25.8	142.0
	15			60.6	82.2	26.3	169.1			60.5	60.3	26.5	147.3
	20			62.9	84.8	27.0	174.7			63.1	62.5	27.2	152.7

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.7	.4	.4	1.5	2	1	.8	.0	.4	1.1
	20			.8	.4	.4	1.6			.8	.0	.4	1.2
	30			.9	.4	.4	1.6			.9	.0	.5	1.3
	40			.9	.4	.4	1.7			.9	.0	.5	1.4
10	10	4	3	1.5	.7	.8	3.0	6	3	1.5	.8	.7	2.9
	20			1.6	.8	.8	3.2			1.6	.8	.7	3.2
	30			1.7	.8	.9	3.4			1.7	.9	.7	3.3
	40			1.8	.8	.9	3.6			1.9	.9	.7	3.5
20	10	13	5	3.0	2.9	1.3	7.2	8	5	3.0	1.6	1.4	6.0
	20			3.2	3.1	1.4	7.7			3.2	1.7	1.5	6.4
	30			3.4	3.2	1.4	8.1			3.5	1.8	1.6	6.8
	40			3.7	3.4	1.4	8.5			3.7	1.9	1.6	7.3
30	10	15	7	4.5	4.3	2.0	10.8	10	7	4.5	2.3	2.3	9.2
	20			4.8	4.6	2.1	11.5			4.9	2.5	2.5	9.8
	30			5.2	4.8	2.1	12.1			5.2	2.7	2.6	10.5
	40			5.5	5.1	2.1	12.7			5.6	2.8	2.7	11.2
40	10	17	9	6.0	5.7	2.8	14.6	12	9	6.0	3.1	3.1	12.2
	20			6.4	6.1	3.0	15.5			6.5	3.3	3.3	13.1
	30			6.9	6.5	3.1	16.4			7.0	3.6	3.4	14.0
	40			7.3	6.8	3.2	17.4			7.5	3.8	3.6	14.9
50	10	20	12	7.5	7.2	3.5	18.2	15	12	7.5	3.9	4.0	15.5
	20			8.0	7.6	3.7	19.4			8.1	4.2	4.3	16.6
	30			8.6	8.1	3.9	20.6			8.7	4.5	4.5	17.7
	40			9.2	8.5	4.0	21.7			9.4	4.7	4.7	18.8
75	10	25	17	11.2	10.8	5.8	27.8	20	17	11.3	5.9	6.1	23.2
	20			12.1	11.4	6.1	29.6			12.2	6.3	6.4	24.9
	30			12.9	12.1	6.4	31.5			13.1	6.7	6.8	26.6
	40			13.8	12.8	6.8	33.3			14.0	7.1	7.1	28.2
100	10	31	23	15.0	14.4	7.7	37.1	59	23	15.0	16.1	6.6	37.7
	20			16.1	15.3	8.2	39.5			16.2	17.1	7.0	40.4
	30			17.2	16.1	8.6	41.9			17.5	18.2	7.0	42.7
	40			18.3	17.0	9.0	44.4			18.7	19.3	7.0	45.0
125	10	36	28	18.7	18.0	10.1	46.8	64	28	18.8	20.1	8.3	47.1
	20			20.1	19.1	10.7	49.9			20.3	21.4	8.7	50.4
	30			21.5	20.2	11.3	53.0			21.8	22.7	8.7	53.3
	40			22.9	21.3	11.9	56.1			23.4	24.1	8.7	56.2
150	10	68	34	22.5	33.2	9.9	65.6	70	34	22.5	24.1	9.9	56.5
	20			24.1	35.1	10.5	69.8			24.4	25.7	10.5	60.5
	30			25.8	37.1	10.5	73.4			26.2	27.3	10.5	64.0
	40			27.5	39.0	10.5	77.1			28.1	28.9	10.5	67.4
175	10	80	40	26.2	38.7	11.6	76.5	76	40	26.3	28.1	12.6	67.0
	20			28.2	41.0	12.2	81.4			28.4	30.0	13.2	71.6
	30			30.1	43.3	12.2	85.6			30.6	31.8	13.8	76.2
	40			32.1	45.6	12.2	89.9			32.7	33.7	14.4	80.9
200	10	90	45	29.9	44.3	13.2	87.4	81	45	30.0	32.1	14.4	76.6
	20			32.2	46.9	14.0	93.0			32.5	34.2	15.1	81.9
	30			34.4	49.4	14.0	97.9			35.0	36.4	15.8	87.1
	40			36.7	52.1	14.0	102.7			37.4	38.5	16.5	92.4
250	10	112	56	37.4	55.4	16.5	109.3	92	56	37.5	40.2	18.1	95.8
	20			40.2	58.6	17.5	116.3			40.6	42.8	18.9	102.3
	30			43.1	61.8	17.5	122.3			43.7	45.5	19.8	108.9
	40			45.9	65.1	17.5	128.4			46.8	48.1	20.6	115.5
300	10	131	67	44.9	66.4	21.5	132.8	103	67	45.0	48.2	21.7	114.9
	20			48.3	70.3	22.5	141.0			48.7	51.4	22.7	122.8
	30			51.7	74.2	23.5	149.3			52.4	54.5	23.7	130.7
	40			55.0	78.1	24.5	157.6			56.1	57.8	24.7	138.6
350	10	143	79	52.4	77.5	25.0	154.9	115	79	52.6	56.2	28.0	136.8
	20			56.3	82.0	26.2	164.6			56.9	59.9	29.5	146.3
	30			60.3	86.5	27.4	174.2			61.2	63.6	31.0	155.8
	40			64.2	91.1	28.6	183.9			65.5	67.4	32.5	165.4
400	10	154	90	59.9	88.6	28.6	177.1	126	90	60.1	64.3	32.0	156.4
	20			64.4	93.7	30.0	188.1			65.0	68.5	33.8	167.2
	30			68.9	98.9	31.3	199.1			69.9	72.7	35.5	178.1
	40			73.4	104.1	32.7	210.2			74.8	77.0	37.2	189.0

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.4	1.6		2	1	.8	.0	.5	1.2
	20			.8	.4	.4	1.7				.8	.0	.5	1.3
	30			.9	.4	.4	1.7				.9	.0	.5	1.4
	40			.9	.5	.4	1.8				1.0	.0	.6	1.5
10	10	4	3	1.5	.8	.8	3.2		6	3	1.6	.9	.8	3.2
	20			1.6	.8	.9	3.4				1.7	.9	.8	3.4
	30			1.7	.9	.9	3.5				1.8	1.0	.8	3.6
	40			1.9	.9	1.0	3.7				1.9	1.0	.8	3.7
20	10	14	6	3.1	3.2	1.6	7.8		9	6	3.1	1.7	1.6	6.4
	20			3.3	3.3	1.6	8.2				3.4	1.8	1.7	6.9
	30			3.5	3.5	1.6	8.6				3.6	1.9	1.7	7.2
	40			3.7	3.7	1.6	9.0				3.9	2.0	1.8	7.7
30	10	17	9	4.6	4.7	2.4	11.8		12	9	4.7	2.6	2.6	9.8
	20			4.9	5.0	2.6	12.5				5.1	2.7	2.7	10.5
	30			5.2	5.3	2.6	13.1				5.4	2.9	2.8	11.1
	40			5.6	5.5	2.7	13.8				5.8	3.1	3.0	11.8
40	10	19	11	6.1	6.3	3.2	15.7		14	11	6.2	3.4	3.6	13.2
	20			6.6	6.7	3.4	16.7				6.7	3.6	3.8	14.1
	30			7.0	7.0	3.4	17.4				7.2	3.9	3.9	15.0
	40			7.4	7.4	3.5	18.4				7.7	4.1	4.1	15.9
50	10	22	14	7.7	7.9	4.0	19.6		17	14	7.8	4.3	4.7	16.8
	20			8.2	8.4	4.3	20.8				8.4	4.5	5.0	18.0
	30			8.7	8.8	4.3	21.8				9.0	4.8	5.3	19.1
	40			9.3	9.2	4.4	22.9				9.6	5.1	5.6	20.3
75	10	29	21	11.5	11.9	6.4	29.8		57	21	11.7	13.3	6.0	31.0
	20			12.3	12.5	6.7	31.6				12.6	14.1	6.0	32.7
	30			13.1	13.2	7.0	33.4				13.5	14.8	6.0	34.4
	40			13.9	13.9	7.4	35.1				14.5	15.6	6.0	36.1
100	10	36	28	15.4	15.8	8.9	40.1		64	28	15.6	17.7	8.0	41.3
	20			16.4	16.7	9.4	42.5				16.8	18.7	8.0	43.6
	30			17.5	17.6	9.8	44.9				18.1	19.8	8.0	45.8
	40			18.6	18.5	10.3	47.3				19.3	20.8	8.0	48.1
125	10	68	34	19.2	30.7	10.0	59.9		70	34	19.5	22.1	10.0	51.6
	20			20.5	32.3	10.0	62.8				21.0	23.4	10.0	54.5
	30			21.9	33.9	10.0	65.7				22.6	24.7	10.0	57.3
	40			23.2	35.5	10.0	68.7				24.1	26.1	10.0	60.1
150	10	82	41	23.0	36.8	12.0	71.9		77	41	23.4	26.6	12.4	62.4
	20			24.6	38.7	12.0	75.4				25.3	28.1	13.1	66.5
	30			26.2	40.7	12.0	78.9				27.1	29.7	13.1	69.9
	40			27.8	42.6	12.0	82.4				28.9	31.3	13.6	73.8
175	10	96	48	26.9	43.0	14.0	83.8		84	48	27.3	31.0	14.5	72.8
	20			28.7	45.2	14.0	87.9				29.5	32.8	15.3	77.5
	30			30.6	47.4	14.0	92.0				31.6	34.6	15.3	81.5
	40			32.5	49.7	14.0	96.1				33.7	36.5	15.9	86.1
200	10	110	55	30.7	49.1	16.0	95.8		91	55	31.2	35.4	16.5	83.2
	20			32.8	51.7	16.0	100.5				33.7	37.5	17.5	88.6
	30			35.0	54.2	16.0	105.2				36.1	39.6	17.5	93.2
	40			37.1	56.8	16.0	109.9				38.5	41.7	18.2	98.4
250	10	132	68	38.4	61.4	20.4	120.2		104	68	39.1	44.3	20.7	104.0
	20			41.1	64.6	21.6	127.2				42.1	46.9	21.8	110.8
	30			43.7	67.8	21.6	133.1				45.1	49.5	21.9	116.5
	40			46.4	71.0	22.4	139.8				48.2	52.1	22.7	123.0
300	10	146	82	46.1	73.7	24.5	144.3		118	82	46.9	53.1	26.9	126.8
	20			49.3	77.5	25.9	152.6				50.5	56.2	28.1	134.8
	30			52.5	81.3	25.9	159.7				54.2	59.4	29.4	142.9
	40			55.7	85.2	26.9	167.8				57.8	62.5	30.6	151.0
350	10	160	96	53.8	86.0	28.6	168.3		132	96	54.7	62.0	31.3	148.0
	20			57.5	90.4	30.2	178.1				58.9	65.6	32.8	157.3
	30			61.2	94.9	30.2	186.3				63.2	69.3	34.2	166.7
	40			64.9	99.4	31.4	195.7				67.4	73.0	35.7	176.2
400	10	173	109	61.4	98.3	32.7	192.4		145	109	62.5	70.8	37.1	170.4
	20			65.7	103.3	34.5	203.5				67.3	75.0	39.0	181.3
	30			70.0	108.4	34.6	212.9				72.2	79.2	40.9	192.2
	40			74.2	113.6	35.9	223.7				77.1	83.4	42.7	203.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.5	1.7	4	2	.8	.5	.5	1.8
	20			.9	.4	.5	1.8			.9	.5	.5	1.8
	30			.9	.5	.5	1.8			.9	.5	.5	1.9
	40			1.0	.5	.5	1.9			1.0	.5	.5	2.0
10	10	5	4	1.6	.8	.9	3.4	7	4	1.7	.9	.9	3.5
	20			1.7	.9	1.0	3.6			1.8	1.0	.9	3.7
	30			1.8	.9	1.0	3.8			1.8	1.0	.9	3.8
	40			1.9	1.0	1.1	4.0			2.0	1.1	.9	4.0
20	10	15	7	3.2	3.4	1.9	8.5	10	7	3.3	1.8	1.9	7.1
	20			3.4	3.6	1.9	8.9			3.5	1.9	2.0	7.5
	30			3.6	3.8	1.9	9.3			3.7	2.1	2.0	7.8
	40			3.8	4.0	1.9	9.6			3.9	2.2	2.1	8.2
30	10	18	10	4.8	5.1	2.8	12.7	13	10	5.0	2.8	2.8	10.6
	20			5.1	5.4	2.8	13.3			5.3	2.9	3.0	11.2
	30			5.4	5.7	2.8	13.9			5.5	3.1	3.2	11.8
	40			5.8	5.9	3.0	14.7			5.9	3.2	3.3	12.5
40	10	21	13	6.4	6.9	3.7	17.0	16	13	6.7	3.7	4.1	14.4
	20			6.8	7.2	3.7	17.8			7.0	3.9	4.3	15.2
	30			7.2	7.6	3.7	18.5			7.4	4.1	4.6	16.0
	40			7.7	7.9	4.0	19.5			7.8	4.3	4.8	16.9
50	10	24	16	8.0	8.6	4.7	21.2	19	16	8.3	4.6	5.1	18.1
	20			8.5	9.0	4.7	22.2			8.8	4.9	5.4	19.1
	30			9.1	9.5	4.7	23.2			9.2	5.1	5.7	20.0
	40			9.6	9.9	4.9	24.4			9.8	5.4	6.0	21.2
75	10	32	24	12.0	12.9	7.1	31.9	60	24	12.5	14.4	6.9	33.8
	20			12.8	13.5	7.5	33.8			13.2	15.2	6.9	35.3
	30			13.6	14.2	7.6	35.4			13.8	15.9	6.9	36.7
	40			14.4	14.8	7.9	37.1			14.7	16.7	7.0	38.4
100	10	40	32	16.0	17.1	9.4	42.5	68	32	16.7	19.2	9.3	45.1
	20			17.1	18.0	10.1	45.2			17.5	20.2	9.3	47.0
	30			18.1	18.9	10.6	47.6			18.4	21.2	9.3	48.9
	40			19.2	19.8	11.1	50.0			19.6	22.3	9.3	51.2
125	10	80	40	20.0	33.4	11.6	65.0	76	40	20.8	24.0	12.0	56.8
	20			21.3	35.0	11.6	67.9			21.9	25.3	12.0	59.2
	30			22.6	36.6	11.6	70.8			23.0	26.6	12.0	61.6
	40			24.0	38.2	11.6	73.7			24.5	27.9	12.7	65.0
150	10	94	47	24.0	40.1	13.9	78.0	83	47	25.0	28.8	14.4	68.1
	20			25.6	42.0	13.9	81.5			26.3	30.3	14.4	71.0
	30			27.2	43.9	13.9	85.0			27.6	31.9	14.4	73.9
	40			28.8	45.8	13.9	88.5			29.4	33.4	15.2	78.0
175	10	110	55	28.0	46.8	16.2	91.0	91	55	29.2	33.6	16.8	79.5
	20			29.8	49.0	16.2	95.0			30.7	35.4	16.8	82.8
	30			31.7	51.2	16.2	99.1			32.2	37.2	16.8	86.2
	40			33.6	53.4	16.2	103.2			34.3	39.0	17.7	91.0
200	10	126	63	32.0	53.5	18.5	104.0	99	63	33.3	38.4	19.2	90.9
	20			34.1	56.0	18.5	108.6			35.1	40.4	19.2	94.7
	30			36.2	58.5	18.5	113.3			36.8	42.5	19.2	98.5
	40			38.4	61.1	18.5	118.0			39.2	44.6	20.3	104.0
250	10	143	79	40.0	66.9	23.7	130.5	115	79	41.6	47.9	24.8	114.4
	20			42.6	70.0	23.7	136.3			43.8	50.5	26.1	120.5
	30			45.3	73.1	23.7	142.1			46.0	53.1	26.6	125.7
	40			48.0	76.3	25.0	149.3			49.0	55.7	27.6	132.3
300	10	158	94	48.0	80.3	28.4	156.6	130	94	50.0	57.5	29.8	137.3
	20			51.2	84.0	28.4	163.6			52.6	60.6	31.4	144.6
	30			54.4	87.8	28.4	170.6			55.2	63.7	31.9	150.9
	40			57.5	91.6	30.0	179.2			58.8	66.9	33.2	158.8
350	10	174	110	56.0	93.6	33.2	182.8	146	110	58.3	67.1	34.7	160.2
	20			59.7	98.0	33.2	190.8			61.4	70.7	37.1	169.2
	30			63.4	102.4	33.2	199.0			64.5	74.4	38.8	177.6
	40			67.1	106.9	35.0	209.0			68.6	78.0	40.5	187.0
400	10	189	125	64.0	107.0	37.9	208.9	161	125	66.6	76.7	39.7	183.1
	20			68.2	112.0	37.9	218.1			70.1	80.8	42.5	193.4
	30			72.5	117.0	37.9	227.4			73.7	85.0	44.3	203.0
	40			76.7	122.1	40.0	238.9			78.4	89.2	46.2	213.8

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.9	.5	.5	1.8		4	2	.9	.5	.5	1.9
	20			.9	.5	.5	1.9				.9	.5	.5	2.0
	30			.9	.5	.5	2.0				1.0	.5	.5	2.1
	40			1.0	.5	.5	2.0				1.0	.6	.5	2.1
10	10	5	4	1.7	.9	1.1	3.7		7	4	1.8	1.0	1.1	3.8
	20			1.8	.9	1.1	3.8				1.9	1.0	1.1	4.0
	30			1.8	1.0	1.1	4.0				1.9	1.1	1.1	4.1
	40			1.9	1.0	1.2	4.2				2.0	1.2	1.1	4.3
20	10	16	8	3.4	3.7	2.1	9.2		11	8	3.6	2.0	2.2	7.7
	20			3.6	3.9	2.1	9.5				3.7	2.1	2.2	8.0
	30			3.7	4.1	2.1	9.9				3.9	2.2	2.2	8.3
	40			3.9	4.2	2.1	10.2				4.1	2.3	2.3	8.7
30	10	19	11	5.1	5.6	3.2	13.9		14	11	5.3	3.0	3.2	11.5
	20			5.3	5.8	3.2	14.4				5.6	3.1	3.2	12.0
	30			5.5	6.1	3.2	14.8				5.8	3.3	3.4	12.6
	40			5.8	6.4	3.2	15.4				6.1	3.5	3.6	13.1
40	10	23	15	6.8	7.4	4.3	18.5		18	15	7.1	4.0	4.4	15.5
	20			7.1	7.8	4.3	19.1				7.5	4.2	4.7	16.3
	30			7.4	8.1	4.3	19.8				7.8	4.4	4.9	17.1
	40			7.8	8.5	4.3	20.5				8.1	4.6	5.1	17.9
50	10	26	18	8.5	9.3	5.4	23.2		21	18	8.9	4.9	5.5	19.4
	20			8.9	9.7	5.4	24.0				9.3	5.2	5.8	20.4
	30			9.2	10.1	5.4	24.8				9.7	5.5	6.1	21.4
	40			9.7	10.6	5.7	26.0				10.2	5.8	6.4	22.3
75	10	35	27	12.8	13.9	8.1	34.8		63	27	13.3	15.6	7.9	36.9
	20			13.3	14.6	8.1	36.0				14.0	16.3	7.9	38.3
	30			13.8	15.2	8.5	37.6				14.6	17.1	7.9	39.7
	40			14.6	15.9	8.9	39.3				15.3	17.9	7.9	41.1
100	10	72	36	17.1	29.1	10.6	56.7		72	36	17.8	20.8	10.6	49.1
	20			17.8	30.3	10.6	58.7				18.6	21.8	10.6	51.0
	30			18.5	31.6	10.6	60.6				19.5	22.8	10.6	52.9
	40			19.5	32.8	10.6	62.9				20.3	23.8	10.6	54.8
125	10	90	45	21.3	36.4	13.2	70.9		81	45	22.2	26.0	13.7	61.9
	20			22.2	37.9	13.2	73.3				23.3	27.2	13.7	64.2
	30			23.1	39.5	13.2	75.8				24.4	28.5	13.7	66.6
	40			24.3	41.0	13.2	78.6				25.4	29.8	13.7	68.9
150	10	108	54	25.6	43.7	15.9	85.1		90	54	26.7	31.2	16.4	74.3
	20			26.6	45.5	15.9	88.0				28.0	32.7	16.4	77.1
	30			27.7	47.4	15.9	90.9				29.2	34.2	16.5	79.9
	40			29.2	49.2	15.9	94.3				30.5	35.8	16.5	82.7
175	10	126	63	29.8	50.9	18.5	99.3		99	63	31.1	36.3	19.2	86.7
	20			31.1	53.1	18.5	102.7				32.6	38.1	19.2	89.9
	30			32.3	55.2	18.5	106.1				34.1	39.9	19.2	93.2
	40			34.0	57.4	18.5	110.0				35.6	41.7	19.2	96.5
200	10	136	72	34.1	58.2	21.7	114.0		108	72	35.6	41.5	21.9	99.0
	20			35.5	60.7	21.7	117.8				37.3	43.6	21.9	102.8
	30			36.9	63.1	21.7	121.7				39.0	45.6	21.9	106.5
	40			38.9	65.7	21.7	126.2				40.7	47.7	21.9	110.3
250	10	154	90	42.6	72.8	27.1	142.5		126	90	44.5	51.9	28.4	124.8
	20			44.4	75.8	27.1	147.3				46.6	54.4	28.4	129.4
	30			46.1	78.9	27.1	152.2				48.7	57.0	28.4	134.1
	40			48.6	82.1	27.1	157.8				50.8	59.6	29.9	140.3
300	10	172	108	51.2	87.3	32.5	171.0		144	108	53.4	62.3	34.0	149.7
	20			53.3	91.0	32.5	176.7				55.9	65.3	34.0	155.3
	30			55.4	94.7	32.5	182.6				58.5	68.4	34.1	160.9
	40			58.4	98.5	32.5	189.4				61.0	71.5	35.9	168.4
350	10	189	125	59.7	101.9	37.9	199.4		161	125	62.3	72.7	39.7	174.7
	20			62.1	106.1	37.9	206.2				65.2	76.2	39.7	181.2
	30			64.6	110.5	37.9	213.0				68.2	79.8	41.8	189.9
	40			68.1	114.9	37.9	220.9				71.2	83.4	43.4	198.0
400	10	207	143	68.2	116.4	44.3	228.9		179	143	71.2	83.1	45.4	199.6
	20			71.0	121.3	44.3	236.6				74.6	87.1	45.4	207.1
	30			73.8	126.3	44.3	244.4				78.0	91.2	47.8	217.0
	40			77.8	131.3	46.8	255.9				81.4	95.4	49.6	226.3



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.5	.6	2.0	6	3	.9	.5	.6	2.1
	20			1.0	.5	.6	2.1			1.0	.6	.6	2.1
	30			1.0	.5	.6	2.1			1.0	.6	.6	2.2
	40			1.0	.6	.6	2.2			1.1	.6	.6	2.3
10	10	13	5	1.8	2.0	1.2	5.0	8	5	1.9	1.1	1.2	4.1
	20			1.9	2.1	1.2	5.2			2.0	1.1	1.2	4.3
	30			2.0	2.2	1.2	5.3			2.0	1.2	1.2	4.4
	40			2.0	2.3	1.2	5.5			2.1	1.2	1.2	4.6
20	10	17	9	3.7	4.0	2.4	10.1	12	9	3.8	2.1	2.4	8.3
	20			3.8	4.2	2.4	10.4			3.9	2.2	2.4	8.6
	30			4.0	4.3	2.4	10.7			4.1	2.3	2.4	8.9
	40			4.1	4.5	2.4	11.0			4.3	2.4	2.4	9.1
30	10	21	13	5.5	6.0	3.6	15.1	16	13	5.7	3.2	3.7	12.6
	20			5.7	6.2	3.6	15.6			5.9	3.3	3.7	13.0
	30			5.9	6.5	3.6	16.1			6.1	3.5	3.7	13.4
	40			6.1	6.8	3.6	16.5			6.4	3.7	4.0	14.0
40	10	25	17	7.3	8.0	4.9	20.2	20	17	7.5	4.2	5.0	16.7
	20			7.6	8.3	4.9	20.8			7.9	4.5	5.0	17.3
	30			7.9	8.7	4.9	21.4			8.2	4.7	5.0	17.8
	40			8.2	9.0	4.9	22.1			8.5	4.9	5.3	18.7
50	10	29	21	9.2	10.0	6.1	25.2	57	21	9.4	11.2	6.0	26.6
	20			9.5	10.4	6.1	26.0			9.8	11.7	6.0	27.5
	30			9.9	10.9	6.1	26.8			10.2	12.2	6.0	28.4
	40			10.2	11.3	6.1	27.6			10.6	12.7	6.0	29.3
75	10	39	31	13.8	15.0	9.1	37.8	67	31	14.1	16.8	8.9	39.9
	20			14.3	15.6	9.1	39.0			14.7	17.6	8.9	41.2
	30			14.8	16.3	9.1	40.2			15.3	18.3	8.9	42.6
	40			15.3	16.9	9.6	41.9			16.0	19.1	8.9	44.0
100	10	82	41	18.4	31.5	11.9	61.8	77	41	18.8	22.4	12.4	53.6
	20			19.1	32.7	11.9	63.7			19.7	23.4	12.4	55.4
	30			19.8	34.0	11.9	65.6			20.5	24.4	12.4	57.2
	40			20.5	35.2	11.9	67.6			21.3	25.4	12.4	59.1
125	10	102	51	23.0	39.4	14.9	77.3	87	51	23.6	28.0	15.4	67.0
	20			23.8	40.9	14.9	79.7			24.6	29.3	15.4	69.3
	30			24.7	42.4	14.9	82.1			25.6	30.5	15.4	71.5
	40			25.6	44.0	14.9	84.5			26.6	31.8	15.5	73.8
150	10	122	61	27.5	47.3	17.9	92.7	97	61	28.3	33.6	18.5	80.4
	20			28.6	49.1	17.9	95.6			29.5	35.1	18.5	83.1
	30			29.6	50.9	17.9	98.5			30.7	36.6	18.5	85.9
	40			30.7	52.8	17.9	101.4			31.9	38.2	18.5	88.6
175	10	135	71	32.1	55.2	21.3	108.7	107	71	33.0	39.2	21.6	93.8
	20			33.4	57.3	21.4	112.0			34.4	41.0	21.6	97.0
	30			34.6	59.4	21.4	115.4			35.8	42.7	21.6	100.2
	40			35.8	61.6	21.4	118.8			37.2	44.5	21.6	103.4
200	10	145	81	36.7	63.1	24.4	124.2	117	81	37.7	44.8	25.6	108.1
	20			38.1	65.5	24.4	128.0			39.3	46.8	25.6	111.7
	30			39.5	67.9	24.4	131.9			40.9	48.8	25.6	115.3
	40			40.9	70.4	24.4	135.7			42.5	50.9	25.6	119.0
250	10	165	101	45.9	78.8	30.5	155.2	137	101	47.1	56.0	32.0	135.1
	20			47.7	81.8	30.5	160.0			49.1	58.5	32.0	139.6
	30			49.4	84.9	30.5	164.8			51.2	61.0	32.0	144.2
	40			51.2	88.0	30.5	169.7			53.2	63.6	32.0	148.8
300	10	185	121	55.1	94.6	36.6	186.3	157	121	56.5	67.2	38.4	162.1
	20			57.2	98.2	36.6	192.0			59.0	70.2	38.4	167.6
	30			59.3	101.9	36.6	197.8			61.4	73.3	38.4	173.0
	40			61.4	105.6	36.6	203.6			63.8	76.3	40.4	180.6
350	10	206	142	64.3	110.4	43.7	218.3	178	142	65.9	78.5	44.7	189.1
	20			66.7	114.6	43.7	225.0			68.8	81.9	44.8	195.5
	30			69.2	118.8	43.7	231.7			71.6	85.5	44.8	201.9
	40			71.6	123.2	43.7	238.5			74.5	89.0	47.2	210.7
400	10	226	162	73.5	126.1	49.9	249.5	198	162	75.4	89.7	54.6	219.6
	20			76.3	130.9	49.9	257.1			78.6	93.6	54.6	226.9
	30			79.1	135.8	50.0	264.8			81.8	97.7	57.3	236.9
	40			81.9	140.8	50.0	272.6			85.1	101.8	59.5	246.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.5	.7	2.1	6	3	1.0	.6	.7	2.2
	20			.9	.5	.7	2.1			1.0	.6	.7	2.3
	30			.9	.6	.7	2.2			1.1	.6	.7	2.4
	40			1.0	.6	.7	2.2			1.1	.6	.7	2.4
10	10	13	5	1.7	2.1	1.3	5.2	8	5	2.0	1.1	1.3	4.5
	20			1.8	2.2	1.3	5.3			2.1	1.2	1.3	4.6
	30			1.9	2.3	1.3	5.5			2.2	1.2	1.3	4.7
	40			1.9	2.4	1.3	5.6			2.3	1.3	1.3	4.9
20	10	17	9	3.5	4.3	2.7	10.4	12	9	4.0	2.3	2.7	9.0
	20			3.6	4.4	2.7	10.7			4.2	2.4	2.7	9.3
	30			3.7	4.6	2.7	11.0			4.4	2.5	2.7	9.5
	40			3.8	4.8	2.7	11.3			4.5	2.6	2.7	9.8
30	10	22	14	5.2	6.4	4.0	15.6	17	14	6.0	3.4	4.1	13.6
	20			5.4	6.7	4.0	16.1			6.3	3.5	4.1	14.0
	30			5.6	6.9	4.0	16.5			6.5	3.7	4.1	14.4
	40			5.7	7.2	4.0	16.9			6.8	3.9	4.4	15.0
40	10	26	18	7.0	8.5	5.4	20.9	21	18	8.1	4.5	5.5	18.1
	20			7.2	8.9	5.4	21.5			8.4	4.7	5.5	18.6
	30			7.4	9.2	5.4	22.0			8.7	4.9	5.5	19.2
	40			7.6	9.6	5.4	22.6			9.0	5.2	5.8	20.0
50	10	31	23	8.7	10.7	6.7	26.1	59	23	10.1	12.0	6.6	28.7
	20			9.0	11.1	6.7	26.8			10.5	12.5	6.6	29.6
	30			9.3	11.5	6.7	27.5			10.9	13.0	6.6	30.5
	40			9.5	12.0	6.7	28.3			11.3	13.5	6.6	31.4
75	10	68	34	13.1	25.4	9.9	48.4	70	34	15.1	18.0	9.9	43.0
	20			13.5	26.3	9.9	49.7			15.7	18.7	9.9	44.4
	30			13.9	27.2	9.9	51.0			16.3	19.5	9.9	45.7
	40			14.3	28.1	9.9	52.4			16.9	20.2	9.9	47.1
100	10	90	45	17.4	33.9	13.2	64.5	81	45	20.1	24.0	13.7	57.8
	20			18.0	35.1	13.2	66.3			20.9	25.0	13.7	59.6
	30			18.5	36.3	13.2	68.0			21.8	26.0	13.7	61.4
	40			19.1	37.5	13.2	69.8			22.6	27.0	13.7	63.3
125	10	112	56	21.8	42.3	16.5	80.7	92	56	25.2	30.0	17.1	72.3
	20			22.5	43.8	16.5	82.8			26.2	31.2	17.1	74.5
	30			23.2	45.3	16.5	85.0			27.2	32.5	17.1	76.8
	40			23.9	46.9	16.6	87.3			28.2	33.7	17.1	79.1
150	10	131	67	26.2	50.8	20.3	97.3	103	67	30.2	36.0	20.6	86.8
	20			27.0	52.6	20.3	99.9			31.4	37.5	20.6	89.4
	30			27.8	54.4	20.3	102.5			32.6	39.0	20.6	92.2
	40			28.6	56.2	20.3	105.2			33.8	40.5	20.6	94.9
175	10	143	79	30.5	59.3	23.7	113.5	115	79	35.2	42.0	24.8	102.0
	20			31.5	61.3	23.7	116.5			36.6	43.7	24.8	105.2
	30			32.4	63.5	23.7	119.6			38.1	45.5	24.8	108.4
	40			33.4	65.6	23.7	122.7			39.5	47.2	24.8	111.6
200	10	154	90	34.9	67.7	27.1	129.7	126	90	40.3	48.0	28.4	116.6
	20			36.0	70.1	27.1	133.2			41.9	50.0	28.4	120.2
	30			37.1	72.5	27.1	136.7			43.5	52.0	28.4	123.8
	40			38.2	75.0	27.1	140.2			45.1	54.0	28.4	127.5
250	10	176	112	43.6	84.7	33.8	162.1	148	112	50.3	60.0	35.5	145.8
	20			45.0	87.6	33.8	166.5			52.4	62.5	35.5	150.3
	30			46.3	90.7	33.9	170.9			54.4	64.9	35.5	154.8
	40			47.7	93.7	33.9	175.3			56.4	67.5	35.5	159.4
300	10	198	134	52.3	101.6	41.5	195.5	170	134	60.4	72.0	42.5	174.9
	20			54.0	105.2	41.5	200.7			62.8	74.9	42.6	180.3
	30			55.6	108.8	41.6	206.0			65.3	77.9	42.6	185.8
	40			57.3	112.5	41.6	211.3			67.7	81.0	42.6	191.2
350	10	221	157	61.0	118.6	48.5	228.0	193	157	70.5	84.0	53.0	207.5
	20			63.0	122.7	48.5	234.1			73.3	87.4	53.0	213.7
	30			64.9	126.9	48.5	240.3			76.1	90.9	53.0	220.1
	40			66.8	131.2	48.5	246.5			79.0	94.5	55.7	229.1
400	10	243	179	69.8	135.5	55.4	260.6	215	179	80.5	96.0	60.6	237.1
	20			72.0	140.2	55.4	267.6			83.8	99.9	60.6	244.3
	30			74.2	145.0	55.4	274.6			87.0	103.9	60.6	251.5
	40			76.4	149.9	55.4	281.7			90.2	107.9	63.6	261.8

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD 8	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD 8	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	1.0	.6	.8	2.4	6	3	1.1	.6	.8	2.6
	20			1.0	.6	.8	2.4			1.2	.7	.8	2.6
	30			1.0	.6	.8	2.5			1.2	.7	.8	2.7
	40			1.1	.7	.8	2.5			1.2	.7	.8	2.8
10	10	14	6	2.0	2.4	1.6	6.0	9	6	2.2	1.3	1.6	5.1
	20			2.0	2.5	1.6	6.1			2.3	1.3	1.6	5.3
	30			2.1	2.6	1.6	6.3			2.4	1.4	1.6	5.4
	40			2.1	2.7	1.6	6.4			2.5	1.4	1.6	5.5
20	10	19	11	4.0	4.9	3.2	12.1	14	11	4.5	2.6	3.3	10.3
	20			4.1	5.0	3.2	12.3			4.6	2.7	3.3	10.6
	30			4.2	5.2	3.2	12.6			4.8	2.8	3.3	10.8
	40			4.3	5.4	3.2	12.9			4.9	2.9	3.3	11.1
30	10	25	17	6.0	7.3	4.9	18.1	20	17	6.7	3.8	4.9	15.5
	20			6.1	7.6	4.9	18.5			7.0	4.0	4.9	15.8
	30			6.3	7.8	4.9	18.9			7.2	4.2	4.9	16.2
	40			6.4	8.1	4.9	19.4			7.4	4.3	4.9	16.6
40	10	30	22	7.9	9.7	6.5	24.2	58	22	9.0	11.0	6.4	26.4
	20			8.1	10.1	6.5	24.7			9.3	11.4	6.4	27.0
	30			8.3	10.4	6.5	25.3			9.6	11.8	6.4	27.7
	40			8.5	10.8	6.5	25.8			9.9	12.2	6.4	28.4
50	10	36	28	9.9	12.2	8.1	30.2	64	28	11.2	13.8	8.0	33.0
	20			10.2	12.6	8.1	30.9			11.6	14.2	8.0	33.8
	30			10.4	13.0	8.1	31.6			12.0	14.7	8.0	34.7
	40			10.7	13.5	8.1	32.3			12.4	15.2	8.0	35.5
60	10	66	33	11.9	23.4	9.6	44.9	69	33	13.5	16.5	9.6	39.6
	20			12.2	24.1	9.6	45.9			13.9	17.1	9.6	40.6
	30			12.5	24.8	9.6	46.9			14.4	17.6	9.6	41.6
	40			12.8	25.5	9.6	47.9			14.8	18.2	9.6	42.6
70	10	78	39	13.9	27.3	11.2	52.4	75	39	15.7	19.3	11.6	46.6
	20			14.2	28.1	11.2	53.5			16.2	19.9	11.6	47.7
	30			14.6	28.9	11.2	54.7			16.8	20.6	11.6	48.9
	40			15.0	29.8	11.2	55.9			17.3	21.3	11.6	50.2
80	10	88	44	15.9	31.2	12.8	59.9	80	44	18.0	22.0	13.2	53.2
	20			16.3	32.1	12.8	61.2			18.6	22.8	13.2	54.6
	30			16.7	33.1	12.8	62.5			19.2	23.5	13.2	55.9
	40			17.1	34.0	12.8	63.9			19.8	24.3	13.2	57.3
90	10	98	49	17.9	35.1	14.4	67.3	85	49	20.2	24.8	14.9	59.9
	20			18.3	36.2	14.4	68.8			20.9	25.6	14.9	61.4
	30			18.8	37.2	14.4	70.4			21.6	26.5	14.9	62.9
	40			19.2	38.3	14.4	71.9			22.2	27.4	14.9	64.5
100	10	110	55	19.8	39.0	16.0	74.8	91	55	22.5	27.5	16.5	66.5
	20			20.4	40.2	16.0	76.5			23.2	28.4	16.5	68.2
	30			20.9	41.3	16.0	78.2			24.0	29.4	16.6	69.9
	40			21.4	42.5	16.0	79.9			24.7	30.4	16.6	71.7
120	10	130	66	23.8	46.8	19.6	90.3	102	66	27.0	33.0	19.8	79.8
	20			24.4	48.2	19.6	92.2			27.9	34.1	19.9	81.8
	30			25.0	49.6	19.6	94.3			28.8	35.3	19.9	83.9
	40			25.6	51.0	19.6	96.3			29.7	36.5	19.9	86.0
140	10	141	77	27.8	54.6	22.9	105.3	113	77	31.4	38.5	24.0	93.9
	20			28.5	56.2	22.9	107.6			32.5	39.8	24.0	96.3
	30			29.2	57.9	22.9	110.0			33.5	41.2	24.0	98.7
	40			29.9	59.5	22.9	112.4			34.6	42.5	24.0	101.2
160	10	151	87	31.8	62.5	26.1	120.3	123	87	35.9	44.0	27.4	107.3
	20			32.6	64.3	26.1	123.0			37.1	45.5	27.4	110.1
	30			33.4	66.1	26.2	125.7			38.3	47.1	27.4	112.8
	40			34.2	68.0	26.2	128.4			39.5	48.6	27.4	115.6
180	10	162	98	35.7	70.3	29.4	135.4	134	98	40.4	49.5	30.8	120.8
	20			36.6	72.3	29.4	138.4			41.8	51.2	30.8	123.8
	30			37.6	74.4	29.4	141.4			43.1	52.9	30.9	126.9
	40			38.5	76.5	29.4	144.5			44.5	54.7	30.9	130.1
200	10	173	109	39.7	78.1	32.7	150.4	145	109	44.9	55.0	34.3	134.2
	20			40.7	80.3	32.7	153.7			46.4	56.9	34.3	137.6
	30			41.7	82.7	32.7	157.1			47.9	58.8	34.3	141.0
	40			42.7	85.0	32.7	160.5			49.4	60.8	34.3	144.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MGD A	MOD 8	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	1.1	.6	.9	2.7	7	4	1.3	.7	.9	2.9
	20			1.1	.7	.9	2.7			1.3	.7	.9	3.0
	30			1.2	.7	.9	2.8			1.3	.8	.9	3.0
	40			1.2	.7	.9	2.8			1.4	.8	.9	3.1
10	10	15	7	2.2	2.7	1.9	6.8	10	7	2.5	1.4	1.9	5.8
	20			2.3	2.8	1.9	6.9			2.6	1.5	1.9	5.9
	30			2.3	2.9	1.9	7.0			2.7	1.5	1.9	6.1
	40			2.4	3.0	1.9	7.2			2.7	1.6	1.9	6.2
20	10	21	13	4.4	5.4	3.7	13.6	16	13	5.0	2.8	3.9	11.7
	20			4.5	5.6	3.7	13.8			5.2	2.9	3.9	11.9
	30			4.6	5.7	3.7	14.1			5.3	3.0	3.9	12.2
	40			4.7	5.9	3.7	14.4			5.5	3.1	3.9	12.5
30	10	27	19	6.7	8.1	5.7	20.4	55	19	7.5	9.2	5.6	22.2
	20			6.8	8.4	5.7	20.8			7.7	9.5	5.6	22.7
	30			6.9	8.6	5.7	21.2			8.0	9.7	5.6	23.3
	40			7.1	8.9	5.7	21.6			8.2	10.0	5.6	23.8
40	10	33	25	8.9	10.8	7.5	27.2	61	25	10.0	12.2	7.4	29.7
	20			9.1	11.1	7.5	27.7			10.3	12.6	7.4	30.3
	30			9.3	11.5	7.5	28.3			10.6	13.0	7.4	31.0
	40			9.5	11.8	7.5	28.8			10.9	13.4	7.4	31.7
50	10	40	32	11.1	13.5	9.4	34.0	68	32	12.5	15.3	9.3	37.1
	20			11.3	13.9	9.4	34.7			12.9	15.8	9.3	37.9
	30			11.6	14.4	9.4	35.4			13.3	16.2	9.3	38.8
	40			11.8	14.8	9.4	36.0			13.6	16.7	9.3	39.6
60	10	76	38	13.3	26.2	11.1	50.6	74	38	15.0	18.4	11.5	44.9
	20			13.6	26.8	11.1	51.6			15.5	18.9	11.5	45.9
	30			13.9	27.5	11.1	52.5			15.9	19.5	11.5	46.9
	40			14.2	28.2	11.1	53.5			16.4	20.1	11.5	47.9
70	10	88	44	15.5	30.5	13.0	59.0	80	44	17.5	21.4	13.4	52.4
	20			15.9	31.3	13.0	60.1			18.0	22.1	13.4	53.5
	30			16.2	32.1	13.0	61.3			18.6	22.7	13.4	54.7
	40			16.5	32.9	13.0	62.4			19.1	23.4	13.4	55.9
80	10	100	50	17.7	34.9	14.8	67.5	86	50	20.0	24.5	15.3	59.9
	20			18.1	35.8	14.8	68.7			20.6	25.2	15.3	61.2
	30			18.5	36.7	14.8	70.0			21.2	26.0	15.4	62.6
	40			18.9	37.6	14.8	71.4			21.8	26.8	15.4	63.9
90	10	114	57	20.0	39.3	16.7	75.9	93	57	22.5	27.6	17.3	67.3
	20			20.4	40.3	16.7	77.3			23.2	28.4	17.3	68.8
	30			20.8	41.3	16.7	78.8			23.9	29.2	17.3	70.4
	40			21.3	42.3	16.7	80.3			24.5	30.1	17.3	71.9
100	10	126	63	22.2	43.6	18.5	84.3	99	63	25.0	30.6	19.2	74.8
	20			22.7	44.7	18.5	85.9			25.8	31.5	19.2	76.5
	30			23.2	45.9	18.5	87.6			26.5	32.5	19.2	78.2
	40			23.6	47.0	18.5	89.2			27.3	33.4	19.2	79.9
120	10	139	75	26.6	52.4	22.7	101.7	111	75	30.0	36.7	23.8	90.6
	20			27.2	53.7	22.7	103.6			30.9	37.8	23.8	92.6
	30			27.8	55.0	22.8	105.6			31.8	39.0	23.8	94.6
	40			28.4	56.4	22.8	107.6			32.7	40.1	23.8	96.7
140	10	152	88	31.1	61.1	26.5	118.7	124	88	35.0	42.9	27.8	105.7
	20			31.7	62.6	26.5	120.9			36.1	44.2	27.8	108.0
	30			32.4	64.2	26.5	123.2			37.1	45.5	27.8	110.4
	40			33.1	65.8	26.6	125.5			38.2	46.8	27.8	112.8
160	10	164	100	35.5	69.8	30.3	135.6	136	100	40.0	49.0	31.8	120.8
	20			36.3	71.6	30.3	138.2			41.2	50.5	31.8	123.5
	30			37.0	73.4	30.3	140.8			42.4	52.0	31.8	126.2
	40			37.8	75.2	30.3	143.4			43.6	53.5	31.8	128.9
180	10	177	113	39.9	78.5	34.1	152.6	149	113	45.0	55.1	35.7	135.9
	20			40.8	80.5	34.1	155.4			46.4	56.8	35.7	138.9
	30			41.7	82.6	34.1	158.4			47.7	58.5	35.8	142.0
	40			42.5	84.7	34.1	161.3			49.1	60.2	35.8	145.1
200	10	189	125	44.4	87.3	37.9	169.5	161	125	50.0	61.2	39.7	151.0
	20			45.3	89.5	37.9	172.7			51.5	63.1	39.7	154.3
	30			46.3	91.7	37.9	176.0			53.0	65.0	39.7	157.7
	40			47.3	94.1	37.9	179.3			54.5	66.9	39.7	161.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	1.2	.7	1.1	3.0	7	4	1.4	.8	1.1	3.2
	20			1.3	.7	1.1	3.1			1.4	.8	1.1	3.3
	30			1.3	.8	1.1	3.1			1.4	.8	1.1	3.4
	40			1.3	.8	1.1	3.2			1.5	.9	1.1	3.4
10	10	16	8	2.5	3.0	2.1	7.6	11	8	2.7	1.6	2.2	6.5
	20			2.5	3.1	2.1	7.8			2.8	1.6	2.2	6.6
	30			2.6	3.2	2.1	7.9			2.9	1.7	2.2	6.8
	40			2.6	3.3	2.1	8.0			3.0	1.7	2.2	6.9
20	10	23	15	4.9	6.1	4.3	15.3	18	15	5.5	3.1	4.5	13.1
	20			5.0	6.2	4.3	15.6			5.6	3.3	4.5	13.4
	30			5.1	6.4	4.3	15.8			5.8	3.4	4.5	13.6
	40			5.2	6.6	4.3	16.1			5.9	3.5	4.5	13.8
30	10	31	23	7.4	9.1	6.5	23.0	59	23	8.2	10.4	6.4	25.0
	20			7.5	9.3	6.5	23.4			8.4	10.6	6.4	25.5
	30			7.7	9.6	6.5	23.8			8.7	10.9	6.4	26.0
	40			7.8	9.9	6.5	24.2			8.9	11.2	6.4	26.5
40	10	38	30	9.9	12.1	8.7	30.7	66	30	11.0	13.8	8.6	33.4
	20			10.1	12.5	8.7	31.2			11.3	14.2	8.6	34.0
	30			10.2	12.8	8.7	31.7			11.5	14.6	8.6	34.7
	40			10.4	13.1	8.7	32.3			11.8	14.9	8.6	35.3
50	10	74	37	12.3	24.7	10.7	47.8	73	37	13.7	17.3	11.1	42.1
	20			12.6	25.3	10.7	48.5			14.1	17.7	11.1	42.9
	30			12.8	25.8	10.7	49.3			14.4	18.2	11.1	43.7
	40			13.0	26.4	10.7	50.1			14.8	18.7	11.1	44.5
60	10	90	45	14.8	29.7	12.8	57.3	81	45	16.5	20.8	13.3	50.6
	20			15.1	30.3	12.8	58.2			16.9	21.3	13.3	51.5
	30			15.3	31.0	12.8	59.2			17.3	21.8	13.3	52.5
	40			15.6	31.6	12.9	60.1			17.7	22.4	13.3	53.5
70	10	104	52	17.3	34.6	15.0	66.9	88	52	19.2	24.2	15.5	59.0
	20			17.6	35.4	15.0	67.9			19.7	24.8	15.5	60.1
	30			17.9	36.1	15.0	69.0			20.2	25.5	15.5	61.2
	40			18.2	36.9	15.0	70.1			20.7	26.1	15.6	62.4
80	10	118	59	19.7	39.6	17.1	76.4	95	59	22.0	27.7	17.8	67.4
	20			20.1	40.4	17.1	77.6			22.5	28.4	17.8	68.7
	30			20.5	41.3	17.1	78.9			23.1	29.1	17.8	70.0
	40			20.8	42.2	17.1	80.1			23.7	29.8	17.8	71.3
90	10	131	67	22.2	44.5	19.7	86.5	103	67	24.7	31.1	20.0	75.8
	20			22.6	45.5	19.7	87.8			25.3	31.9	20.0	77.3
	30			23.0	46.5	19.7	89.2			26.0	32.7	20.0	78.7
	40			23.4	47.5	19.7	90.6			26.6	33.6	20.0	80.2
100	10	138	74	24.7	49.5	21.9	96.1	110	74	27.5	34.6	23.0	85.1
	20			25.1	50.5	21.9	97.6			28.2	35.5	23.0	86.6
	30			25.6	51.6	21.9	99.1			28.9	36.4	23.0	88.3
	40			26.0	52.7	21.9	100.7			29.6	37.3	23.0	89.9
120	10	153	89	29.6	59.4	26.3	115.3	125	89	33.0	41.5	27.6	102.1
	20			30.2	60.6	26.3	117.1			33.8	42.6	27.6	104.0
	30			30.7	61.9	26.3	118.9			34.6	43.7	27.6	105.9
	40			31.2	63.3	26.3	120.8			35.5	44.8	27.6	107.9
140	10	167	103	34.5	69.3	30.7	134.5	139	103	38.5	48.4	32.2	119.1
	20			35.2	70.7	30.7	136.6			39.4	49.7	32.2	121.3
	30			35.8	72.3	30.7	138.8			40.4	50.9	32.2	123.6
	40			36.4	73.8	30.7	141.0			41.4	52.2	32.2	125.9
160	10	182	118	39.5	79.2	35.1	153.7	154	118	43.9	55.4	36.8	136.1
	20			40.2	80.8	35.1	156.1			45.1	56.8	36.8	138.6
	30			40.9	82.6	35.1	158.6			46.2	58.2	36.8	141.2
	40			41.6	84.4	35.1	161.1			47.3	59.7	36.8	143.8
180	10	197	133	44.4	89.0	40.4	173.8	169	133	49.4	62.3	41.4	153.1
	20			45.2	90.9	40.4	176.6			50.7	63.9	41.4	156.0
	30			46.0	92.9	40.4	179.4			52.0	65.5	41.4	158.9
	40			46.9	94.9	40.4	182.2			53.2	67.2	41.4	161.8
200	10	212	148	49.4	98.9	44.9	193.2	184	148	54.9	69.2	49.2	173.4
	20			50.3	101.1	44.9	196.2			56.3	71.0	49.2	176.5
	30			51.2	103.2	44.9	199.3			57.7	72.8	49.3	179.8
	40			52.1	105.5	44.9	202.4			59.1	74.6	49.3	183.0

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.4	1.7	1.2	4.2		8	5	1.5	.9	1.2	3.6
	20			1.4	1.7	1.2	4.3				1.5	.9	1.2	3.6
	30			1.4	1.8	1.2	4.4				1.6	.9	1.2	3.7
	40			1.4	1.8	1.2	4.4				1.6	.9	1.2	3.8
10	10	17	9	2.7	3.3	2.4	8.5		12	9	3.0	1.7	2.5	7.2
	20			2.8	3.4	2.4	8.6				3.1	1.8	2.5	7.3
	30			2.8	3.5	2.4	8.8				3.1	1.8	2.5	7.4
	40			2.9	3.6	2.4	8.9				3.2	1.9	2.5	7.6
20	10	25	17	5.5	6.7	4.9	17.0		20	17	6.0	3.4	4.9	14.4
	20			5.6	6.8	4.9	17.3				6.2	3.6	4.9	14.6
	30			5.6	7.0	4.9	17.6				6.3	3.7	4.9	14.9
	40			5.7	7.2	4.9	17.8				6.4	3.8	4.9	15.1
30	10	33	25	8.2	10.0	7.4	25.6		61	25	9.0	11.5	7.2	27.7
	20			8.3	10.2	7.4	26.0				9.2	11.7	7.2	28.2
	30			8.5	10.5	7.4	26.3				9.4	12.0	7.2	28.7
	40			8.6	10.8	7.4	26.7				9.7	12.3	7.2	29.2
40	10	68	34	10.9	21.9	9.7	42.5		70	34	12.0	15.3	9.7	37.0
	20			11.1	22.4	9.7	43.1				12.3	15.6	9.7	37.6
	30			11.3	22.8	9.7	43.7				12.6	16.0	9.7	38.3
	40			11.5	23.2	9.7	44.3				12.9	16.4	9.7	38.9
50	10	84	42	13.7	27.4	12.1	53.2		78	42	15.0	19.1	12.5	46.7
	20			13.9	27.9	12.1	53.9				15.4	19.6	12.5	47.5
	30			14.1	28.5	12.1	54.6				15.7	20.0	12.5	48.3
	40			14.3	29.0	12.1	55.4				16.1	20.4	12.5	49.1
60	10	100	50	16.4	32.9	14.5	63.8		86	50	18.1	23.0	15.0	56.0
	20			16.7	33.5	14.5	64.7				18.5	23.5	15.0	57.0
	30			16.9	34.2	14.5	65.6				18.9	24.0	15.0	57.9
	40			17.2	34.8	14.5	66.5				19.3	24.5	15.0	58.9
70	10	118	59	19.1	38.4	16.9	74.4		95	59	21.1	26.8	17.5	65.4
	20			19.4	39.1	16.9	75.4				21.6	27.4	17.5	66.5
	30			19.7	39.9	16.9	76.5				22.0	28.0	17.5	67.6
	40			20.1	40.6	16.9	77.6				22.5	28.6	17.5	68.7
80	10	131	67	21.9	43.9	19.8	85.5		103	67	24.1	30.6	20.0	74.7
	20			22.2	44.7	19.8	86.7				24.6	31.3	20.0	76.0
	30			22.6	45.5	19.8	87.9				25.2	32.0	20.0	77.2
	40			22.9	46.4	19.8	89.1				25.8	32.7	20.1	78.5
90	10	139	75	24.6	49.4	22.2	96.2		111	75	27.1	34.4	23.4	84.9
	20			25.0	50.3	22.3	97.5				27.7	35.2	23.4	86.3
	30			25.4	51.2	22.3	98.9				28.3	36.0	23.4	87.7
	40			25.8	52.2	22.3	100.3				29.0	36.8	23.4	89.2
100	10	148	84	27.3	54.9	24.7	106.9		120	84	30.1	38.3	26.0	94.3
	20			27.8	55.9	24.7	108.4				30.8	39.1	26.0	95.9
	30			28.2	56.9	24.7	109.9				31.5	40.0	26.0	97.5
	40			28.7	58.0	24.8	111.4				32.2	40.9	26.0	99.1
120	10	164	100	32.8	65.8	29.7	128.3		136	100	36.1	45.9	31.2	113.2
	20			33.3	67.1	29.7	130.0				37.0	46.9	31.2	115.1
	30			33.9	68.3	29.7	131.9				37.8	48.0	31.2	117.0
	40			34.4	69.6	29.7	133.7				38.6	49.1	31.2	118.9
140	10	181	117	38.2	76.8	34.6	149.7		153	117	42.1	53.6	36.4	132.1
	20			38.9	78.2	34.6	151.7				43.1	54.8	36.4	134.2
	30			39.5	79.7	34.6	153.8				44.1	56.0	36.4	136.5
	40			40.1	81.2	34.7	156.0				45.1	57.2	36.4	138.7
160	10	198	134	43.7	87.8	40.5	172.0		170	134	48.2	61.2	41.5	150.9
	20			44.4	89.4	40.5	174.4				49.3	62.6	41.6	153.4
	30			45.1	91.1	40.5	176.8				50.4	64.0	41.6	156.0
	40			45.9	92.8	40.6	179.2				51.5	65.4	41.6	158.5
180	10	214	150	49.2	98.7	45.6	193.5		186	150	54.2	68.9	50.0	173.1
	20			50.0	100.6	45.6	196.1				55.4	70.4	50.1	175.9
	30			50.8	102.5	45.6	198.9				56.7	72.0	50.1	178.8
	40			51.6	104.4	45.6	201.6				58.0	73.6	50.1	181.7
200	10	231	167	54.6	109.7	50.6	215.0		203	167	60.2	76.5	55.6	192.3
	20			55.5	111.8	50.7	217.9				61.6	78.2	55.6	195.5
	30			56.4	113.9	50.7	221.0				63.0	80.0	55.6	198.6
	40			57.3	116.0	50.7	224.0				64.4	81.8	55.7	201.8

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.5	1.8	1.3	4.6	8	5	1.5	.9	1.3	3.8
	20			1.5	1.8	1.3	4.7			1.5	.9	1.3	3.8
	30			1.5	1.9	1.3	4.7			1.6	1.0	1.3	3.9
	40			1.6	1.9	1.3	4.8			1.6	1.0	1.3	3.9
10	10	17	9	3.0	3.6	2.7	9.2	12	9	3.0	1.8	2.7	7.6
	20			3.0	3.6	2.7	9.3			3.1	1.9	2.7	7.7
	30			3.1	3.7	2.7	9.5			3.1	1.9	2.7	7.8
	40			3.1	3.8	2.7	9.6			3.2	2.0	2.7	7.9
20	10	26	18	6.0	7.1	5.4	18.4	21	18	6.1	3.7	5.4	15.1
	20			6.0	7.3	5.4	18.7			6.2	3.8	5.4	15.4
	30			6.1	7.4	5.4	19.0			6.3	3.9	5.4	15.6
	40			6.2	7.6	5.4	19.2			6.4	4.0	5.4	15.8
30	10	35	27	8.9	10.7	8.1	27.7	63	27	9.1	12.2	7.9	29.3
	20			9.1	10.9	8.1	28.1			9.3	12.5	7.9	29.7
	30			9.2	11.2	8.1	28.5			9.4	12.8	7.9	30.1
	40			9.3	11.4	8.1	28.8			9.6	13.0	7.9	30.6
40	10	72	36	11.9	23.4	10.6	45.9	72	36	12.1	16.3	10.6	39.0
	20			12.1	23.8	10.6	46.5			12.4	16.7	10.6	39.6
	30			12.3	24.3	10.6	47.1			12.6	17.0	10.6	40.2
	40			12.5	24.7	10.6	47.7			12.8	17.4	10.6	40.8
50	10	90	45	14.9	29.3	13.2	57.4	81	45	15.2	20.4	13.7	49.3
	20			15.1	29.8	13.2	58.1			15.4	20.8	13.7	50.0
	30			15.3	30.3	13.2	58.9			15.7	21.3	13.7	50.7
	40			15.6	30.9	13.2	59.7			16.0	21.7	13.7	51.4
60	10	108	54	17.9	35.2	15.9	68.9	90	54	18.2	24.5	16.4	59.1
	20			18.1	35.8	15.9	69.8			18.5	25.0	16.4	60.0
	30			18.4	36.4	15.9	70.7			18.9	25.5	16.4	60.8
	40			18.7	37.0	15.9	71.6			19.2	26.0	16.5	61.7
70	10	126	63	20.8	41.0	18.5	80.4	99	63	21.2	28.6	19.2	69.0
	20			21.2	41.7	18.5	81.4			21.6	29.2	19.2	70.0
	30			21.5	42.5	18.5	82.5			22.0	29.8	19.2	71.0
	40			21.8	43.2	18.5	83.5			22.4	30.4	19.2	72.0
80	10	136	72	23.8	46.9	21.6	92.3	108	72	24.3	32.7	21.9	78.8
	20			24.2	47.7	21.7	93.5			24.7	33.3	21.9	80.0
	30			24.5	48.5	21.7	94.7			25.1	34.0	21.9	81.1
	40			24.9	49.4	21.7	96.0			25.6	34.7	21.9	82.3
90	10	145	81	26.8	52.7	24.4	103.9	117	81	27.3	36.7	25.5	89.5
	20			27.2	53.6	24.4	105.2			27.8	37.5	25.5	90.8
	30			27.6	54.6	24.4	106.6			28.3	38.3	25.5	92.1
	40			28.0	55.6	24.4	107.9			28.8	39.1	25.5	93.4
100	10	154	90	29.8	58.6	27.1	115.4	126	90	30.3	40.8	28.3	99.5
	20			30.2	59.6	27.1	116.9			30.9	41.7	28.4	100.9
	30			30.7	60.7	27.1	118.4			31.4	42.5	28.4	102.3
	40			31.1	61.7	27.1	119.9			32.0	43.4	28.4	103.8
120	10	172	108	35.7	70.3	32.5	138.5	144	108	36.4	49.0	34.0	119.4
	20			36.3	71.5	32.5	140.3			37.1	50.0	34.0	121.1
	30			36.8	72.8	32.5	142.1			37.7	51.0	34.0	122.8
	40			37.4	74.1	32.5	143.9			38.4	52.1	34.1	124.5
140	10	189	125	41.7	82.0	37.9	161.6	161	125	42.5	57.1	39.7	139.3
	20			42.3	83.4	37.9	163.7			43.2	58.3	39.7	141.3
	30			42.9	84.9	37.9	165.8			44.0	59.5	39.7	143.3
	40			43.6	86.4	37.9	167.9			44.8	60.8	39.7	145.3
160	10	207	143	47.6	93.7	44.3	185.7	179	143	48.5	65.3	45.4	159.2
	20			48.4	95.4	44.3	188.0			49.4	66.6	45.4	161.4
	30			49.1	97.0	44.3	190.4			50.3	68.0	45.4	163.7
	40			49.8	98.8	44.3	192.9			51.2	69.5	45.4	166.0
180	10	225	161	53.6	105.5	49.8	208.9	197	161	54.6	73.5	54.5	182.5
	20			54.4	107.3	49.8	211.5			55.6	75.0	54.5	185.1
	30			55.2	109.2	49.9	214.2			56.6	76.5	54.5	187.6
	40			56.0	111.1	49.9	217.0			57.6	78.1	54.5	190.2
200	10	243	179	59.6	117.2	55.4	232.1	215	179	60.7	81.6	60.5	202.8
	20			60.5	119.2	55.4	235.0			61.8	83.3	60.5	205.6
	30			61.4	121.3	55.4	238.1			62.9	85.0	60.6	208.5
	40			62.3	123.4	55.4	241.1			64.0	86.8	60.6	211.4

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.6	2.0	1.5	5.1		9	6	1.6	1.0	1.5	4.2
	20			1.7	2.0	1.5	5.2				1.7	1.0	1.5	4.2
	30			1.7	2.1	1.5	5.2				1.7	1.1	1.5	4.3
	40			1.7	2.1	1.5	5.3				1.7	1.1	1.5	4.3
10	10	19	11	3.3	4.0	3.0	10.2		14	11	3.3	2.0	3.0	8.4
	20			3.3	4.1	3.0	10.4				3.3	2.1	3.0	8.5
	30			3.4	4.1	3.0	10.5				3.4	2.1	3.0	8.6
	40			3.4	4.2	3.0	10.6				3.4	2.2	3.0	8.7
15	10	24	16	4.9	6.0	4.5	15.4		19	16	4.9	3.1	4.6	12.6
	20			5.0	6.1	4.5	15.6				5.0	3.1	4.6	12.7
	30			5.0	6.2	4.5	15.7				5.1	3.2	4.6	12.9
	40			5.1	6.3	4.5	15.9				5.2	3.3	4.6	13.0
20	10	29	21	6.5	7.9	6.1	20.5		57	21	6.6	9.2	5.9	21.8
	20			6.6	8.1	6.1	20.8				6.7	9.4	6.0	22.0
	30			6.7	8.3	6.1	21.1				6.8	9.5	6.0	22.3
	40			6.8	8.4	6.1	21.3				6.9	9.7	6.0	22.6
25	10	35	27	8.2	9.9	7.6	25.7		63	27	8.2	11.5	7.4	27.2
	20			8.3	10.1	7.6	26.0				8.4	11.7	7.4	27.5
	30			8.4	10.3	7.6	26.3				8.5	11.9	7.4	27.9
	40			8.5	10.6	7.6	26.6				8.6	12.1	7.4	28.2
30	10	40	32	9.8	11.9	9.1	30.8		68	32	9.9	13.8	8.9	32.6
	20			9.9	12.2	9.1	31.2				10.0	14.1	8.9	33.0
	30			10.1	12.4	9.1	31.6				10.2	14.3	8.9	33.4
	40			10.2	12.7	9.1	32.0				10.3	14.6	8.9	33.8
35	10	74	37	11.4	23.2	10.4	45.0		73	37	11.5	16.1	10.8	38.5
	20			11.6	23.5	10.4	45.5				11.7	16.4	10.8	38.9
	30			11.7	23.9	10.4	46.0				11.9	16.7	10.8	39.4
	40			11.9	24.2	10.4	46.6				12.1	17.0	10.8	39.9
40	10	84	42	13.1	26.5	11.9	51.5		78	42	13.2	18.4	12.4	44.0
	20			13.2	26.9	11.9	52.0				13.4	18.7	12.4	44.5
	30			13.4	27.3	11.9	52.6				13.6	19.1	12.4	45.0
	40			13.6	27.7	11.9	53.2				13.8	19.4	12.4	45.6
45	10	94	47	14.7	29.8	13.4	57.9		83	47	14.8	20.7	13.9	49.5
	20			14.9	30.3	13.4	58.5				15.1	21.1	13.9	50.1
	30			15.1	30.7	13.4	59.2				15.3	21.5	13.9	50.7
	40			15.3	31.2	13.4	59.9				15.5	21.8	13.9	51.3
50	10	106	53	16.3	33.2	14.9	64.4		89	53	16.5	23.0	15.5	55.0
	20			16.5	33.6	14.9	65.1				16.7	23.4	15.5	55.6
	30			16.8	34.1	14.9	65.8				17.0	23.8	15.5	56.3
	40			17.0	34.6	14.9	66.5				17.2	24.3	15.5	57.0
55	10	116	58	18.0	36.5	16.4	70.8		94	58	18.1	25.3	17.0	60.5
	20			18.2	37.0	16.4	71.6				18.4	25.8	17.0	61.2
	30			18.4	37.5	16.4	72.3				18.7	26.2	17.0	61.9
	40			18.7	38.1	16.4	73.2				19.0	26.7	17.0	62.7
60	10	126	63	19.6	39.8	17.8	77.2		99	63	19.8	27.7	18.5	66.0
	20			19.9	40.4	17.9	78.1				20.1	28.1	18.5	66.8
	30			20.1	40.9	17.9	78.9				20.4	28.6	18.6	67.6
	40			20.4	41.5	17.9	79.8				20.7	29.1	18.6	68.4
70	10	137	73	22.8	46.4	21.3	90.6		109	73	23.1	32.3	22.4	77.8
	20			23.2	47.1	21.4	91.6				23.4	32.8	22.5	78.7
	30			23.5	47.8	21.4	92.6				23.8	33.4	22.5	79.6
	40			23.8	48.5	21.4	93.6				24.1	34.0	22.5	80.6
80	10	148	84	26.1	53.0	24.4	103.6		120	84	26.4	36.9	25.7	88.9
	20			26.5	53.8	24.4	104.7				26.8	37.5	25.7	89.9
	30			26.8	54.6	24.4	105.8				27.2	38.1	25.7	91.0
	40			27.2	55.4	24.4	107.0				27.6	38.8	25.7	92.1
90	10	158	94	29.4	59.7	27.4	116.5		130	94	29.7	41.5	28.9	100.0
	20			29.8	60.5	27.5	117.8				30.1	42.2	28.9	101.2
	30			30.2	61.4	27.5	119.1				30.6	42.9	28.9	102.4
	40			30.6	62.3	27.5	120.4				31.0	43.7	28.9	103.6
100	10	169	105	32.6	66.3	30.5	129.4		141	105	33.0	46.1	32.1	111.1
	20			33.1	67.3	30.5	130.9				33.5	46.9	32.1	112.4
	30			33.5	68.2	30.5	132.3				34.0	47.7	32.1	113.8
	40			34.0	69.2	30.5	133.8				34.5	48.5	32.1	115.1



## 240 CHARACTER DATA RECORD

1410/1301 DISK INPUT AND OUTPUT 7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.8	2.1	1.6	5.5		9	6	1.8	1.1	1.6	4.5
	20			1.8	2.2	1.6	5.6				1.8	1.1	1.6	4.6
	30			1.8	2.2	1.6	5.6				1.8	1.1	1.6	4.6
	40			1.8	2.3	1.6	5.7				1.9	1.2	1.6	4.7
10	10	20	12	3.5	4.3	3.3	11.1		15	12	3.6	2.2	3.3	9.1
	20			3.6	4.4	3.3	11.2				3.6	2.2	3.3	9.2
	30			3.6	4.4	3.3	11.3				3.7	2.3	3.3	9.3
	40			3.6	4.5	3.3	11.4				3.7	2.3	3.3	9.4
15	10	26	18	5.3	6.4	5.0	16.6		21	18	5.3	3.3	5.0	13.6
	20			5.3	6.5	5.0	16.8				5.4	3.4	5.0	13.8
	30			5.4	6.7	5.0	17.0				5.5	3.4	5.0	13.9
	40			5.5	6.8	5.0	17.2				5.6	3.5	5.0	14.1
20	10	31	23	7.0	8.5	6.6	22.2		59	23	7.1	9.9	6.5	23.6
	20			7.1	8.7	6.6	22.4				7.2	10.1	6.5	23.8
	30			7.2	8.9	6.6	22.7				7.3	10.3	6.5	24.1
	40			7.3	9.0	6.6	22.9				7.4	10.4	6.5	24.3
25	10	37	29	8.8	10.7	8.3	27.7		65	29	8.9	12.4	8.1	29.4
	20			8.9	10.9	8.3	28.0				9.0	12.6	8.1	29.8
	30			9.0	11.1	8.3	28.4				9.1	12.8	8.1	30.1
	40			9.1	11.3	8.3	28.7				9.3	13.0	8.1	30.4
30	10	70	35	10.5	21.5	9.7	41.8		71	35	10.7	14.9	9.7	35.3
	20			10.7	21.8	9.7	42.2				10.8	15.2	9.7	35.7
	30			10.8	22.1	9.7	42.6				11.0	15.4	9.7	36.1
	40			10.9	22.4	9.7	43.0				11.1	15.6	9.7	36.5
35	10	80	40	12.3	25.1	11.4	48.7		76	40	12.4	17.4	11.8	41.7
	20			12.4	25.4	11.4	49.2				12.6	17.7	11.8	42.1
	30			12.6	25.7	11.4	49.7				12.8	18.0	11.8	42.6
	40			12.7	26.1	11.4	50.2				13.0	18.2	11.8	43.0
40	10	92	46	14.0	28.7	13.0	55.7		82	46	14.2	19.9	13.5	47.6
	20			14.2	29.0	13.0	56.2				14.4	20.2	13.5	48.1
	30			14.4	29.4	13.0	56.8				14.6	20.5	13.5	48.6
	40			14.5	29.8	13.0	57.3				14.8	20.8	13.5	49.2
45	10	104	52	15.8	32.2	14.6	62.6		88	52	16.0	22.4	15.2	53.6
	20			16.0	32.7	14.6	63.2				16.2	22.7	15.2	54.1
	30			16.2	33.1	14.6	63.9				16.5	23.1	15.2	54.7
	40			16.4	33.5	14.6	64.5				16.7	23.4	15.2	55.3
50	10	114	57	17.5	35.8	16.2	69.6		93	57	17.8	24.9	16.9	59.5
	20			17.8	36.3	16.2	70.3				18.0	25.3	16.9	60.2
	30			18.0	36.8	16.2	71.0				18.3	25.6	16.9	60.8
	40			18.2	37.3	16.2	71.7				18.6	26.1	16.9	61.5
55	10	126	63	19.3	39.4	17.8	76.6		99	63	19.6	27.4	18.5	65.5
	20			19.5	39.9	17.9	77.3				19.8	27.8	18.5	66.2
	30			19.8	40.4	17.9	78.1				20.1	28.2	18.6	66.9
	40			20.0	41.0	17.9	78.9				20.4	28.7	18.6	67.6
60	10	133	69	21.1	43.0	20.0	84.0		105	69	21.3	29.8	20.2	71.4
	20			21.3	43.5	20.0	84.8				21.6	30.3	20.2	72.2
	30			21.6	44.1	20.0	85.7				22.0	30.8	20.2	73.0
	40			21.8	44.7	20.0	86.5				22.3	31.3	20.2	73.8
70	10	144	80	24.6	50.2	23.3	98.0		116	80	24.9	34.8	24.5	84.2
	20			24.9	50.8	23.3	99.0				25.3	35.4	24.5	85.1
	30			25.2	51.5	23.3	99.9				25.6	35.9	24.5	86.0
	40			25.5	52.2	23.3	100.9				26.0	36.5	24.5	87.0
80	10	155	91	28.1	57.3	26.6	112.0		127	91	28.5	39.8	28.0	96.2
	20			28.4	58.1	26.6	113.1				28.9	40.4	28.0	97.3
	30			28.8	58.8	26.6	114.2				29.3	41.0	28.0	98.3
	40			29.1	59.6	26.6	115.4				29.7	41.7	28.0	99.4
90	10	167	103	31.6	64.5	29.9	126.0		139	103	32.0	44.8	31.5	108.3
	20			32.0	65.3	30.0	127.2				32.5	45.5	31.5	109.4
	30			32.3	66.2	30.0	128.5				32.9	46.2	31.5	110.6
	40			32.7	67.1	30.0	129.8				33.4	46.9	31.5	111.8
100	10	178	114	35.1	71.7	33.3	140.0		150	114	35.6	49.7	35.0	120.3
	20			35.5	72.6	33.3	141.4				36.1	50.5	35.0	121.6
	30			35.9	73.5	33.3	142.8				36.6	51.3	35.0	122.9
	40			36.4	74.5	33.3	144.2				37.1	52.1	35.0	124.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.9	2.3	1.8	6.0		10	7	1.9	1.2	1.8	4.9
	20			1.9	2.3	1.8	6.0				1.9	1.2	1.8	4.9
	30			1.9	2.4	1.8	6.1				2.0	1.2	1.8	5.0
	40			2.0	2.4	1.8	6.2				2.0	1.3	1.8	5.0
10	10	21	13	3.8	4.6	3.6	12.0		16	13	3.8	2.4	3.7	9.9
	20			3.8	4.7	3.6	12.1				3.9	2.4	3.7	10.0
	30			3.9	4.8	3.6	12.2				3.9	2.5	3.7	10.1
	40			3.9	4.9	3.6	12.3				3.9	2.5	3.7	10.2
15	10	27	19	5.7	6.9	5.4	18.0		55	19	5.7	8.1	5.3	19.1
	20			5.7	7.0	5.4	18.2				5.8	8.2	5.3	19.3
	30			5.8	7.2	5.4	18.4				5.9	8.3	5.3	19.5
	40			5.9	7.3	5.4	18.6				5.9	8.4	5.3	19.7
20	10	33	25	7.6	9.2	7.2	24.0		61	25	7.6	10.8	7.1	25.5
	20			7.6	9.4	7.2	24.2				7.7	10.9	7.1	25.7
	30			7.7	9.6	7.2	24.5				7.8	11.1	7.1	26.0
	40			7.8	9.7	7.2	24.8				7.9	11.3	7.1	26.2
25	10	40	32	9.4	11.5	9.0	30.0		68	32	9.5	13.5	8.8	31.9
	20			9.6	11.7	9.0	30.3				9.6	13.7	8.8	32.2
	30			9.7	11.9	9.0	30.6				9.8	13.9	8.8	32.5
	40			9.8	12.1	9.0	30.9				9.9	14.1	8.9	32.8
30	10	76	38	11.3	23.4	10.6	45.3		74	38	11.4	16.2	11.0	38.6
	20			11.5	23.6	10.6	45.7				11.6	16.4	11.0	39.0
	30			11.6	23.9	10.6	46.1				11.7	16.7	11.0	39.4
	40			11.7	24.2	10.6	46.5				11.8	16.9	11.0	39.8
35	10	88	44	13.2	27.3	12.4	52.9		80	44	13.3	18.9	12.9	45.1
	20			13.4	27.6	12.4	53.3				13.5	19.2	12.9	45.5
	30			13.5	27.9	12.4	53.8				13.7	19.4	12.9	46.0
	40			13.7	28.2	12.4	54.3				13.8	19.7	12.9	46.4
40	10	100	50	15.1	31.2	14.1	60.4		86	50	15.2	21.6	14.7	51.5
	20			15.3	31.5	14.2	61.0				15.4	21.9	14.7	52.0
	30			15.5	31.9	14.2	61.5				15.6	22.2	14.7	52.5
	40			15.6	32.3	14.2	62.1				15.8	22.5	14.7	53.0
45	10	114	57	17.0	35.1	15.9	68.0		93	57	17.1	24.3	16.5	58.0
	20			17.2	35.5	15.9	68.6				17.3	24.6	16.5	58.5
	30			17.4	35.9	15.9	69.2				17.6	25.0	16.6	59.1
	40			17.6	36.3	15.9	69.8				17.8	25.3	16.6	59.7
50	10	126	63	18.9	39.0	17.7	75.5		99	63	19.0	27.0	18.4	64.4
	20			19.1	39.4	17.7	76.2				19.3	27.4	18.4	65.0
	30			19.3	39.8	17.7	76.9				19.5	27.8	18.4	65.7
	40			19.5	40.3	17.7	77.6				19.7	28.1	18.4	66.3
55	10	133	69	20.8	42.9	19.9	83.6		105	69	20.9	29.7	20.2	70.9
	20			21.0	43.3	20.0	84.3				21.2	30.1	20.2	71.5
	30			21.3	43.8	20.0	85.1				21.5	30.5	20.2	72.2
	40			21.5	44.4	20.0	85.8				21.7	31.0	20.2	72.9
60	10	139	75	22.7	46.7	21.8	91.2		111	75	22.8	32.4	22.9	78.1
	20			22.9	47.3	21.8	92.0				23.1	32.8	22.9	78.9
	30			23.2	47.8	21.8	92.8				23.4	33.3	22.9	79.6
	40			23.4	48.4	21.8	93.6				23.7	33.8	22.9	80.4
70	10	152	88	26.5	54.5	25.4	106.4		124	88	26.6	37.8	26.7	91.2
	20			26.8	55.1	25.4	107.3				27.0	38.3	26.7	92.0
	30			27.1	55.8	25.4	108.3				27.3	38.9	26.7	92.9
	40			27.4	56.5	25.4	109.2				27.6	39.4	26.8	93.8
80	10	164	100	30.2	62.3	29.0	121.6		136	100	30.4	43.2	30.5	104.2
	20			30.6	63.0	29.0	122.6				30.8	43.8	30.6	105.2
	30			30.9	63.8	29.0	123.7				31.2	44.4	30.6	106.2
	40			31.3	64.5	29.1	124.8				31.6	45.0	30.6	107.2
90	10	177	113	34.0	70.1	32.6	136.8		149	113	34.2	48.6	34.4	117.2
	20			34.4	70.9	32.7	138.0				34.7	49.3	34.4	118.3
	30			34.8	71.7	32.7	139.2				35.1	50.0	34.4	119.5
	40			35.2	72.6	32.7	140.4				35.5	50.7	34.4	120.6
100	10	189	125	37.8	77.9	36.3	152.0		161	125	38.0	54.0	38.2	130.3
	20			38.2	78.8	36.3	153.3				38.5	54.7	38.2	131.5
	30			38.6	79.7	36.3	154.6				39.0	55.5	38.2	132.7
	40			39.1	80.6	36.3	156.0				39.5	56.3	38.2	134.0

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	2.0	2.4	1.9	6.2		10	7	2.0	1.2	1.9	5.1
	20			2.0	2.4	1.9	6.3				2.0	1.2	1.9	5.2
	30			2.0	2.4	1.9	6.3				2.1	1.3	1.9	5.2
	40			2.1	2.5	1.9	6.4				2.1	1.3	1.9	5.3
10	10	21	13	4.0	4.7	3.7	12.4		16	13	4.0	2.4	3.9	10.3
	20			4.0	4.8	3.7	12.6				4.1	2.5	3.9	10.4
	30			4.1	4.9	3.7	12.7				4.1	2.5	3.9	10.5
	40			4.1	5.0	3.7	12.8				4.2	2.6	3.9	10.6
15	10	27	19	6.0	7.1	5.7	18.7		55	19	6.0	8.2	5.6	19.8
	20			6.1	7.2	5.7	18.9				6.1	8.3	5.6	20.0
	30			6.1	7.3	5.7	19.1				6.2	8.4	5.6	20.2
	40			6.2	7.4	5.7	19.3				6.3	8.6	5.6	20.4
20	10	33	25	8.0	9.4	7.5	24.9		61	25	8.0	10.9	7.4	26.4
	20			8.1	9.6	7.5	25.2				8.1	11.1	7.4	26.6
	30			8.2	9.7	7.5	25.4				8.2	11.2	7.4	26.9
	40			8.3	9.9	7.5	25.7				8.3	11.4	7.4	27.2
25	10	40	32	10.0	11.8	9.4	31.2		68	32	10.1	13.7	9.3	33.0
	20			10.1	12.0	9.4	31.5				10.2	13.9	9.3	33.3
	30			10.2	12.2	9.4	31.8				10.3	14.1	9.3	33.6
	40			10.3	12.4	9.4	32.1				10.4	14.3	9.3	34.0
30	10	76	38	12.0	23.7	11.1	46.8		74	38	12.1	16.4	11.5	40.0
	20			12.1	23.9	11.1	47.2				12.2	16.6	11.5	40.4
	30			12.3	24.2	11.1	47.6				12.4	16.9	11.5	40.7
	40			12.4	24.5	11.1	48.0				12.5	17.1	11.5	41.1
35	10	88	44	14.0	27.6	13.0	54.6		80	44	14.1	19.1	13.4	46.6
	20			14.1	27.9	13.0	55.0				14.3	19.4	13.4	47.1
	30			14.3	28.3	13.0	55.5				14.4	19.7	13.4	47.5
	40			14.4	28.6	13.0	56.0				14.6	20.0	13.4	48.0
40	10	100	50	16.0	31.6	14.8	62.4		86	50	16.1	21.9	15.3	53.3
	20			16.2	31.9	14.8	62.9				16.3	22.2	15.3	53.8
	30			16.3	32.3	14.8	63.5				16.5	22.5	15.3	54.3
	40			16.5	32.7	14.8	64.0				16.7	22.8	15.4	54.8
45	10	114	57	18.0	35.5	16.7	70.2		93	57	18.1	24.6	17.3	60.0
	20			18.2	35.9	16.7	70.8				18.3	24.9	17.3	60.5
	30			18.4	36.3	16.7	71.4				18.5	25.3	17.3	61.1
	40			18.6	36.8	16.7	72.0				18.8	25.7	17.3	61.7
50	10	126	63	20.0	39.4	18.5	77.9		99	63	20.1	27.3	19.2	66.6
	20			20.2	39.9	18.5	78.6				20.4	27.7	19.2	67.3
	30			20.4	40.4	18.5	79.3				20.6	28.1	19.2	67.9
	40			20.6	40.9	18.5	80.0				20.8	28.5	19.2	68.6
55	10	133	69	22.0	43.4	20.8	86.2		105	69	22.1	30.1	21.1	73.3
	20			22.2	43.9	20.8	87.0				22.4	30.5	21.1	74.0
	30			22.5	44.4	20.9	87.7				22.7	30.9	21.1	74.7
	40			22.7	45.0	20.9	88.5				22.9	31.4	21.1	75.4
60	10	139	75	24.0	47.3	22.7	94.0		111	75	24.1	32.8	23.8	80.8
	20			24.2	47.9	22.7	94.9				24.4	33.3	23.8	81.5
	30			24.5	48.5	22.7	95.7				24.7	33.7	23.8	82.3
	40			24.8	49.0	22.8	96.6				25.0	34.2	23.8	83.1
70	10	152	88	28.0	55.2	26.5	109.7		124	88	28.2	38.3	27.8	94.2
	20			28.3	55.9	26.5	112.7				28.5	38.8	27.8	95.1
	30			28.6	56.5	26.5	111.7				28.8	39.4	27.8	96.0
	40			28.9	57.2	26.5	112.7				29.2	39.9	27.8	96.9
80	10	164	100	32.0	63.1	30.3	125.4		136	100	32.2	43.7	31.7	107.7
	20			32.3	63.8	30.3	126.5				32.6	44.4	31.7	108.7
	30			32.7	64.6	30.3	127.6				33.0	45.0	31.8	109.7
	40			33.0	65.4	30.3	128.7				33.3	45.6	31.8	110.8
90	10	177	113	36.0	71.0	34.1	141.1		149	113	36.2	49.2	35.7	121.1
	20			36.4	71.8	34.1	142.3				36.6	49.9	35.7	122.3
	30			36.8	72.7	34.1	143.6				37.1	50.6	35.7	123.4
	40			37.1	73.6	34.1	144.8				37.5	51.3	35.8	124.6
100	10	189	125	40.0	78.9	37.9	156.7		161	125	40.2	54.7	39.7	134.6
	20			40.4	79.8	37.9	158.1				40.7	55.4	39.7	135.9
	30			40.8	80.8	37.9	159.5				41.2	56.2	39.7	137.1
	40			41.3	81.7	37.9	160.9				41.7	57.0	39.7	138.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	2.2	2.6	2.0	6.8	10	7	2.2	1.3	2.1	5.5
	40			2.2	2.7	2.0	6.9			2.2	1.4	2.1	5.6
	60			2.2	2.8	2.0	7.0			2.3	1.4	2.1	5.7
	80			2.3	2.8	2.0	7.1			2.3	1.5	2.1	5.8
10	20	22	14	4.3	5.2	4.1	13.5	17	14	4.3	2.7	4.2	11.2
	40			4.4	5.3	4.1	13.8			4.4	2.8	4.2	11.4
	60			4.5	5.5	4.1	14.0			4.5	2.9	4.2	11.6
	80			4.5	5.7	4.1	14.3			4.6	3.0	4.2	11.8
15	20	29	21	6.5	7.8	6.1	20.4	57	21	6.5	9.1	6.0	21.6
	40			6.6	8.0	6.2	20.7			6.6	9.3	6.0	22.0
	60			6.7	8.3	6.2	21.1			6.8	9.5	6.0	22.4
	80			6.8	8.5	6.2	21.5			6.9	9.8	6.1	22.8
20	20	36	28	8.6	10.4	8.2	27.2	64	28	8.7	12.1	8.0	28.8
	40			8.8	10.7	8.2	27.7			8.8	12.4	8.1	29.3
	60			8.9	11.0	8.2	28.2			9.0	12.7	8.1	29.8
	80			9.1	11.4	8.2	28.7			9.2	13.1	8.1	30.3
25	20	70	35	10.8	21.8	10.1	42.6	71	35	10.8	15.1	10.1	36.0
	40			11.0	22.3	10.1	43.3			11.0	15.5	10.1	36.6
	60			11.2	22.7	10.1	44.0			11.3	15.9	10.1	37.3
	80			11.4	23.3	10.1	44.7			11.5	16.3	10.1	37.9
30	20	84	42	12.9	26.2	12.1	51.1	78	42	13.0	18.1	12.5	43.7
	40			13.1	26.7	12.1	51.9			13.3	18.6	12.5	44.4
	60			13.4	27.3	12.1	52.8			13.5	19.1	12.5	45.2
	80			13.6	27.9	12.1	53.6			13.8	19.6	12.5	46.0
35	20	98	49	15.1	30.5	14.1	59.6	85	49	15.2	21.2	14.6	50.9
	40			15.3	31.2	14.1	60.6			15.5	21.7	14.6	51.8
	60			15.6	31.8	14.1	61.6			15.8	22.3	14.6	52.7
	80			15.9	32.6	14.1	62.6			16.1	22.9	14.6	53.6
40	20	112	56	17.2	34.9	16.1	68.2	92	56	17.3	24.2	16.7	58.2
	40			17.5	35.6	16.1	69.2			17.7	24.8	16.7	59.2
	60			17.8	36.4	16.1	70.4			18.0	25.5	16.7	60.2
	80			18.2	37.2	16.1	71.5			18.4	26.1	16.7	61.3
45	20	126	63	19.4	39.2	18.1	76.7	99	63	19.5	27.2	18.8	65.5
	40			19.7	40.1	18.1	77.9			19.9	27.9	18.8	66.6
	60			20.1	40.9	18.1	79.1			20.3	28.6	18.8	67.7
	80			20.4	41.9	18.2	80.4			20.7	29.4	18.8	68.9
50	20	134	70	21.5	43.6	20.6	85.7	106	70	21.6	30.2	20.9	72.8
	40			21.9	44.5	20.6	87.0			22.1	31.0	20.9	74.0
	60			22.3	45.5	20.6	88.4			22.5	31.8	20.9	75.3
	80			22.7	46.5	20.7	89.9			23.0	32.7	20.9	76.6
55	20	141	77	23.7	47.9	22.7	94.3	113	77	23.8	33.3	23.8	80.9
	40			24.1	49.0	22.7	95.7			24.3	34.1	23.8	82.2
	60			24.5	50.0	22.7	97.3			24.8	35.0	23.8	83.6
	80			25.0	51.2	22.7	98.9			25.3	35.9	23.8	85.1
60	20	148	84	25.8	52.3	24.7	102.8	120	84	26.0	36.3	26.0	88.2
	40			26.3	53.4	24.7	104.4			26.5	37.2	26.0	89.7
	60			26.8	54.6	24.8	106.1			27.1	38.2	26.0	91.2
	80			27.2	55.8	24.8	107.8			27.6	39.2	26.0	92.8
70	20	162	98	30.1	61.0	28.8	120.0	134	98	30.3	42.3	30.3	102.9
	40			30.7	62.3	28.9	121.8			30.9	43.4	30.3	104.6
	60			31.2	63.7	28.9	123.8			31.6	44.5	30.3	106.4
	80			31.8	65.1	28.9	125.8			32.2	45.7	30.3	108.3
80	20	176	112	34.4	69.7	33.0	137.1	148	112	34.6	48.4	34.6	117.6
	40			35.0	71.2	33.0	139.2			35.4	49.6	34.6	119.6
	60			35.7	72.8	33.0	141.5			36.1	50.9	34.7	121.7
	80			36.3	74.4	33.0	143.8			36.8	52.3	34.7	123.8
90	20	189	125	38.7	78.5	37.1	154.2	161	125	39.0	54.4	38.9	132.4
	40			39.4	80.1	37.1	156.6			39.8	55.8	39.0	134.6
	60			40.1	81.9	37.1	159.2			40.6	57.3	39.0	136.9
	80			40.9	83.7	37.2	161.8			41.4	58.8	39.0	139.2
100	20	203	139	43.0	87.2	42.2	172.4	175	139	43.3	60.5	43.3	147.1
	40			43.8	89.0	42.2	175.0			44.2	62.0	43.3	149.5
	60			44.6	91.0	42.3	177.8			45.1	63.6	43.3	152.1
	80			45.4	93.0	42.3	180.7			46.0	65.3	43.4	154.7

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	2.8	3.3	2.7	8.7	12	9	2.8	1.7	2.7	7.2
	40			2.8	3.3	2.7	8.8			2.8	1.7	2.7	7.3
	60			2.8	3.4	2.7	8.9			2.9	1.8	2.7	7.4
	80			2.9	3.5	2.7	9.1			2.9	1.8	2.7	7.5
10	20	26	18	5.5	6.5	5.4	17.4	21	18	5.6	3.3	5.4	14.3
	40			5.6	6.7	5.4	17.7			5.7	3.4	5.4	14.5
	60			5.7	6.8	5.4	17.9			5.8	3.5	5.4	14.7
	80			5.8	7.0	5.4	18.2			5.9	3.6	5.4	14.9
15	20	35	27	8.3	9.8	8.1	26.2	63	27	8.4	11.5	7.9	27.8
	40			8.4	10.0	8.1	26.5			8.5	11.7	7.9	28.2
	60			8.5	10.3	8.1	26.9			8.7	11.9	8.0	28.5
	80			8.6	10.5	8.1	27.3			8.8	12.2	8.0	28.9
20	20	72	36	11.1	22.1	10.6	43.8	72	36	11.2	15.3	10.6	37.1
	40			11.2	22.4	10.6	44.3			11.4	15.6	10.6	37.6
	60			11.4	22.8	10.6	44.8			11.6	15.9	10.6	38.0
	80			11.5	23.2	10.6	45.3			11.7	16.2	10.6	38.6
25	20	90	45	13.9	27.6	13.2	54.7	81	45	14.0	19.1	13.7	46.8
	40			14.0	28.1	13.2	55.3			14.2	19.5	13.7	47.4
	60			14.2	28.5	13.3	56.0			14.5	19.9	13.7	48.0
	80			14.4	29.0	13.3	56.7			14.7	20.3	13.7	48.7
30	20	108	54	16.6	33.1	15.9	65.6	90	54	16.8	22.9	16.4	56.2
	40			16.8	33.7	15.9	66.4			17.1	23.4	16.4	56.9
	60			17.1	34.2	15.9	67.2			17.3	23.8	16.5	57.6
	80			17.3	34.8	15.9	68.0			17.6	24.3	16.5	58.4
35	20	126	63	19.4	38.7	18.5	76.6	99	63	19.6	26.8	19.2	65.5
	40			19.6	39.3	18.5	77.5			19.9	27.3	19.2	66.4
	60			19.9	39.9	18.6	78.4			20.2	27.8	19.2	67.2
	80			20.2	40.6	18.6	79.3			20.5	28.4	19.2	68.1
40	20	136	72	22.2	44.2	21.6	88.0	108	72	22.4	30.6	21.9	74.9
	40			22.5	44.9	21.7	89.0			22.8	31.2	21.9	75.8
	60			22.7	45.6	21.7	90.1			23.1	31.8	21.9	76.8
	80			23.0	46.4	21.7	91.1			23.5	32.4	22.0	77.9
45	20	145	81	24.9	49.7	24.4	99.0	117	81	25.2	34.4	25.5	85.1
	40			25.3	50.5	24.4	100.1			25.6	35.0	25.5	86.2
	60			25.6	51.3	24.4	101.3			26.0	35.7	25.5	87.3
	80			25.9	52.2	24.4	102.5			26.4	36.5	25.6	88.4
50	20	154	90	27.7	55.2	27.1	110.0	126	90	28.0	38.2	28.3	94.6
	40			28.1	56.1	27.1	111.3			28.5	38.9	28.4	95.8
	60			28.4	57.0	27.1	112.6			28.9	39.7	28.4	97.0
	80			28.8	58.0	27.1	113.9			29.4	40.5	28.4	98.3
55	20	163	99	30.5	60.8	29.8	121.0	135	99	30.8	42.1	31.2	104.0
	40			30.9	61.7	29.8	122.4			31.3	42.8	31.2	105.3
	60			31.3	62.7	29.8	123.8			31.8	43.7	31.2	106.7
	80			31.7	63.8	29.8	125.3			32.3	44.6	31.2	108.1
60	20	172	108	33.2	66.3	32.5	132.0	144	108	33.6	45.9	34.0	113.5
	40			33.7	67.3	32.5	133.5			34.1	46.7	34.0	114.9
	60			34.1	68.5	32.5	135.1			34.7	47.7	34.0	116.4
	80			34.5	69.6	32.5	136.7			35.2	48.6	34.1	117.9
70	20	189	125	38.8	77.3	37.9	154.0	161	125	39.2	53.5	39.7	132.4
	40			39.3	78.6	37.9	155.8			39.8	54.5	39.7	134.1
	60			39.8	79.9	37.9	157.6			40.5	55.6	39.7	135.8
	80			40.3	81.2	38.0	159.5			41.1	56.7	39.8	137.6
80	20	207	143	44.3	88.4	44.3	177.0	179	143	44.8	61.2	45.3	151.3
	40			44.9	89.8	44.3	179.0			45.5	62.3	45.4	153.2
	60			45.5	91.3	44.3	181.1			46.3	63.5	45.4	155.2
	80			46.1	92.8	44.4	183.3			47.0	64.8	45.5	157.3
90	20	225	161	49.9	99.4	49.8	199.1	197	161	50.4	68.8	54.4	173.7
	40			50.5	101.0	49.9	201.4			51.2	70.1	54.5	175.8
	60			51.2	102.7	49.9	203.7			52.0	71.5	54.5	178.0
	80			51.8	104.4	49.9	206.2			52.8	72.9	54.5	180.3
100	20	243	179	55.4	110.5	55.3	221.2	215	179	56.0	76.5	60.5	192.9
	40			56.1	112.2	55.4	223.7			56.9	77.9	60.5	195.3
	60			56.9	114.1	55.4	226.4			57.8	79.4	60.6	197.8
	80			57.6	116.0	55.5	229.1			58.7	81.0	60.6	200.4

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	3.5	4.4	3.5	11.4	16	13	3.5	2.2	3.6	9.3
	40			3.5	4.4	3.5	11.4			3.5	2.2	3.6	9.4
	60			3.5	4.4	3.5	11.5			3.6	2.3	3.6	9.5
	80			3.5	4.5	3.5	11.6			3.6	2.3	3.6	9.6
10	20	33	25	6.9	8.8	7.1	22.8	61	25	7.0	10.3	6.9	24.2
	40			7.0	8.8	7.1	22.8			7.1	10.4	6.9	24.4
	60			7.0	8.9	7.1	23.0			7.2	10.6	6.9	24.7
	80			7.1	9.1	7.1	23.2			7.3	10.7	6.9	24.9
15	20	76	38	10.4	23.0	10.4	43.7	74	38	10.5	15.5	10.8	36.8
	40			10.5	22.8	10.4	43.6			10.6	15.7	10.8	37.1
	60			10.6	22.8	10.4	43.8			10.7	15.8	10.8	37.4
	80			10.6	23.1	10.4	44.1			10.9	16.0	10.8	37.7
20	20	100	50	13.8	30.6	13.8	58.3	86	50	14.0	20.7	14.4	49.0
	40			13.9	30.4	13.8	58.1			14.2	20.9	14.4	49.4
	60			14.1	30.5	13.8	58.4			14.3	21.1	14.4	49.9
	80			14.2	30.8	13.9	58.8			14.5	21.4	14.4	50.3
25	20	126	63	17.3	38.3	17.3	72.9	99	63	17.5	25.8	18.0	61.3
	40			17.4	38.0	17.3	72.7			17.7	26.1	18.0	61.8
	60			17.6	38.1	17.3	73.0			17.9	26.4	18.0	62.3
	80			17.7	38.5	17.3	73.5			18.1	26.7	18.0	62.9
30	20	139	75	20.8	45.9	21.3	88.0	111	75	21.0	31.0	22.4	74.4
	40			20.9	45.5	21.3	87.8			21.2	31.3	22.5	75.0
	60			21.1	45.7	21.3	88.1			21.5	31.7	22.5	75.7
	80			21.3	46.2	21.3	88.8			21.8	32.1	22.5	76.3
35	20	152	88	24.2	53.6	24.8	102.6	124	88	24.5	36.2	26.2	86.8
	40			24.4	53.1	24.8	102.4			24.8	36.5	26.2	87.5
	60			24.6	53.3	24.9	102.8			25.1	37.0	26.2	88.3
	80			24.8	53.9	24.9	103.6			25.4	37.4	26.2	89.1
40	20	164	100	27.7	61.3	28.4	117.3	136	100	28.0	41.3	29.9	99.2
	40			27.9	60.7	28.4	117.0			28.3	41.8	29.9	100.0
	60			28.1	60.9	28.4	117.5			28.7	42.3	30.0	100.9
	80			28.4	61.6	28.4	118.4			29.0	42.8	30.0	101.8
45	20	177	113	31.1	68.9	31.9	131.9	149	113	31.5	46.5	33.7	111.6
	40			31.4	68.3	31.9	131.6			31.9	47.0	33.7	112.5
	60			31.7	68.5	32.0	132.2			32.2	47.5	33.7	113.5
	80			31.9	69.3	32.0	133.2			32.6	48.1	33.8	114.5
50	20	189	125	34.6	76.6	35.5	146.6	161	125	35.0	51.7	37.4	124.0
	40			34.9	75.9	35.5	146.3			35.4	52.2	37.5	125.1
	60			35.2	76.2	35.5	146.8			35.8	52.8	37.5	126.1
	80			35.5	77.0	35.5	148.0			36.3	53.5	37.5	127.3
55	20	202	138	38.0	84.2	40.0	162.3	174	138	38.5	56.8	41.2	136.5
	40			38.4	83.5	40.1	161.9			38.9	57.4	41.2	137.6
	60			38.7	83.8	40.1	162.6			39.4	58.1	41.2	138.7
	80			39.0	84.7	40.1	163.8			39.9	58.8	41.3	140.0
60	20	214	150	41.5	91.9	43.7	177.1	186	150	42.0	62.0	48.4	152.3
	40			41.8	91.1	43.7	176.6			42.5	62.6	48.4	153.6
	60			42.2	91.4	43.7	177.3			43.0	63.4	48.5	154.8
	80			42.6	92.4	43.8	178.7			43.5	64.2	48.5	156.2
65	20	227	163	45.0	99.5	47.3	191.8	199	163	45.5	67.2	52.4	165.0
	40			45.3	98.7	47.3	191.4			46.0	67.9	52.5	166.4
	60			45.7	99.0	47.4	192.1			46.6	68.7	52.5	167.7
	80			46.1	100.1	47.4	193.6			47.1	69.5	52.5	169.2
70	20	239	175	48.4	107.2	50.9	206.6	211	175	49.0	72.3	56.5	177.7
	40			48.8	106.3	51.0	206.1			49.6	73.1	56.5	179.1
	60			49.2	106.6	51.0	206.9			50.2	73.9	56.5	180.6
	80			49.7	107.8	51.1	208.5			50.8	74.9	56.6	182.2
75	20	247	192	51.9	114.9	54.6	221.3	224	188	52.5	77.5	60.5	190.4
	40			52.3	113.9	54.6	220.8			53.1	78.3	60.5	191.9
	60			52.8	114.2	54.7	221.7			53.7	79.2	60.6	193.6
	80			53.2	115.5	54.7	223.4			54.4	80.2	60.6	195.2

## 750 CHARACTER DATA RECORD

1410/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	5.4	7.4	5.5	18.3	57	21	5.4	8.7	5.4	19.5
	40			5.4	7.4	5.5	18.3			5.4	8.7	5.4	19.6
	60			5.4	7.4	5.5	18.3			5.4	8.7	5.4	19.6
	80			5.4	7.4	5.5	18.4			5.4	8.7	5.4	19.6
10	20	84	42	10.8	25.6	10.8	47.3	78	42	10.8	17.4	11.3	39.6
	40			10.8	25.7	10.8	47.3			10.8	17.4	11.3	39.6
	60			10.8	25.7	10.8	47.4			10.8	17.5	11.3	39.6
	80			10.8	25.7	10.9	47.4			10.8	17.4	11.3	39.6
15	20	126	63	16.2	38.5	16.2	70.9	99	63	16.2	26.1	17.0	59.3
	40			16.2	38.5	16.2	71.0			16.2	26.2	17.0	59.4
	60			16.2	38.5	16.3	71.1			16.2	26.2	17.0	59.4
	80			16.2	38.6	16.3	71.1			16.2	26.1	17.0	59.4
20	20	148	84	21.7	51.3	22.3	95.2	120	84	21.7	34.8	23.6	80.1
	40			21.7	51.3	22.3	95.3			21.7	34.9	23.7	80.2
	60			21.7	51.4	22.3	95.4			21.7	34.9	23.7	80.3
	80			21.7	51.5	22.3	95.4			21.7	34.8	23.7	80.2
25	20	169	105	27.1	64.1	27.8	119.0	141	105	27.1	43.6	29.5	100.2
	40			27.1	64.2	27.9	119.1			27.1	43.6	29.6	100.3
	60			27.1	64.2	27.9	119.2			27.1	43.7	29.6	100.3
	80			27.1	64.3	27.9	119.3			27.1	43.6	29.6	100.3
30	20	189	125	32.5	76.9	33.4	142.8	161	125	32.5	52.3	35.5	120.3
	40			32.5	77.0	33.4	142.9			32.5	52.3	35.5	120.4
	60			32.5	77.1	33.5	143.0			32.5	52.4	35.6	120.5
	80			32.5	77.2	33.5	143.2			32.5	52.3	35.6	120.4
40	20	231	167	43.3	102.5	45.9	191.7	203	167	43.3	69.7	51.5	164.5
	40			43.3	102.7	45.9	191.9			43.3	69.8	51.6	164.7
	60			43.3	102.8	46.0	192.1			43.3	69.8	51.6	164.8
	80			43.3	102.9	46.0	192.2			43.3	69.7	51.6	164.7
45	20	250	192	49.1	116.3	52.0	217.4	225	189	49.1	79.0	58.4	186.6
	40			49.1	116.4	52.1	217.6			49.1	79.1	58.5	186.7
	60			49.1	116.6	52.1	217.8			49.1	79.2	58.5	186.9
	80			49.1	116.7	52.2	218.0			49.1	79.0	58.6	186.7

## 1000 CHARACTER DATA RECORD

1410/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	40	32	7.6	11.0	7.8	26.4	68	32	7.6	13.0	7.6	28.2
	40			7.6	11.0	7.8	26.4			7.6	13.0	7.6	28.2
	60			7.6	11.0	7.8	26.4			7.6	13.0	7.6	28.2
	80			7.6	11.0	7.8	26.5			7.6	13.0	7.6	28.2
10	20	126	63	15.2	38.0	15.2	68.4	99	63	15.2	25.9	15.9	57.0
	40			15.2	38.1	15.2	68.5			15.2	25.9	15.9	57.1
	60			15.2	38.1	15.2	68.5			15.2	26.0	15.9	57.1
	80			15.2	38.1	15.2	68.6			15.2	26.0	16.0	57.2
15	20	158	94	22.8	57.0	23.5	103.3	130	94	22.8	38.9	25.1	86.8
	40			22.8	57.1	23.5	103.4			22.8	38.9	25.1	86.8
	60			22.8	57.1	23.5	103.5			22.8	39.0	25.1	86.9
	80			22.8	57.2	23.5	103.6			22.8	39.0	25.2	87.0
20	20	189	125	30.4	76.0	31.3	137.7	161	125	30.4	51.8	33.6	115.8
	40			30.4	76.1	31.3	137.9			30.4	51.9	33.6	115.9
	60			30.4	76.2	31.4	138.0			30.4	51.9	33.6	116.0
	80			30.4	76.3	31.4	138.1			30.4	52.0	33.7	116.1
25	20	221	157	38.0	95.0	40.5	173.5	193	157	38.0	64.8	46.1	148.9
	40			38.0	95.1	40.5	173.6			38.0	64.8	46.2	149.0
	60			38.0	95.2	40.5	173.8			38.0	64.9	46.2	149.1
	80			38.0	95.4	40.6	173.9			38.0	65.0	46.2	149.2
30	20	247	192	45.6	114.0	48.6	208.2	224	188	45.6	77.7	55.3	178.7
	40			45.6	114.2	48.6	208.4			45.6	77.8	55.4	178.8
	60			45.6	114.3	48.6	208.6			45.6	77.9	55.4	179.0
	80			45.6	114.4	48.7	208.7			45.6	78.0	55.5	179.1

## 1500 CHARACTER DATA RECORD

1410/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	2.6	4.1	2.6	9.3	16	13	2.6	2.0	2.6	7.3
	40			2.6	4.1	2.6	9.3			2.6	2.0	2.6	7.3
	60			2.6	4.1	2.6	9.3			2.6	2.0	2.6	7.3
	80			2.6	4.1	2.6	9.3			2.6	2.0	2.6	7.3
2	20	33	25	5.3	8.1	5.2	18.6	61	25	5.3	8.1	5.2	18.6
	40			5.3	8.1	5.2	18.6			5.3	8.1	5.2	18.6
	60			5.3	8.1	5.3	18.6			5.3	8.1	5.3	18.6
	80			5.3	8.1	5.3	18.7			5.3	8.1	5.3	18.7
3	20	76	38	7.9	18.3	7.9	34.0	74	38	7.9	12.2	7.9	27.9
	40			7.9	18.3	7.9	34.0			7.9	12.2	7.9	27.9
	60			7.9	18.3	7.9	34.1			7.9	12.2	7.9	28.0
	80			7.9	18.3	7.9	34.1			7.9	12.2	7.9	28.0
4	20	190	50	10.5	24.3	10.5	45.3	86	50	10.5	16.2	10.5	37.2
	40			10.5	24.4	10.5	45.4			10.5	16.2	10.5	37.2
	60			10.5	24.4	10.5	45.4			10.5	16.3	10.5	37.3
	80			10.5	24.4	10.5	45.5			10.5	16.3	10.5	37.3
5	20	126	63	13.1	30.4	13.1	56.6	99	63	13.1	20.3	13.1	46.5
	40			13.1	30.5	13.1	56.7			13.1	20.3	13.1	46.6
	60			13.1	30.5	13.1	56.8			13.1	20.3	13.1	46.6
	80			13.1	30.6	13.2	56.8			13.1	20.4	13.2	46.6
10	20	189	125	26.3	60.8	26.2	113.3	161	125	26.3	40.6	26.2	93.0
	40			26.3	60.9	26.2	113.4			26.3	40.6	26.2	93.1
	60			26.3	61.0	26.3	113.5			26.3	40.7	26.3	93.2
	80			26.3	61.1	26.3	113.7			26.3	40.7	26.3	93.3
15	20	247	192	39.4	91.3	39.3	169.9	224	188	39.4	60.8	39.3	139.5
	40			39.4	91.4	39.4	170.1			39.4	60.9	39.4	139.7
	60			39.4	91.5	39.4	170.3			39.4	61.0	39.4	139.8
	80			39.4	91.7	39.5	170.5			39.4	61.1	39.5	139.9

## 2000 CHARACTER DATA RECORD

1410/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	3.0	4.1	3.0	10.1	16	13	3.0	2.0	3.0	8.1
	40			3.0	4.1	3.0	10.1			3.0	2.0	3.0	8.1
	60			3.0	4.1	3.0	10.2			3.0	2.0	3.0	8.1
	80			3.0	4.1	3.0	10.2			3.0	2.0	3.0	8.1
2	20	33	25	6.1	8.1	6.1	20.3	61	25	6.1	8.1	6.1	20.3
	40			6.1	8.1	6.1	20.3			6.1	8.1	6.1	20.3
	60			6.1	8.1	6.1	20.3			6.1	8.1	6.1	20.3
	80			6.1	8.1	6.1	20.3			6.1	8.1	6.1	20.3
3	20	76	38	9.1	18.3	9.1	36.5	74	38	9.1	12.2	9.1	30.4
	40			9.1	18.3	9.1	36.5			9.1	12.2	9.1	30.4
	60			9.1	18.3	9.1	36.6			9.1	12.2	9.1	30.5
	80			9.1	18.3	9.1	36.6			9.1	12.2	9.1	30.5
4	20	100	50	12.2	24.3	12.2	48.7	86	50	12.2	16.2	12.2	40.5
	40			12.2	24.4	12.2	48.7			12.2	16.2	12.2	40.6
	60			12.2	24.4	12.2	48.7			12.2	16.3	12.2	40.6
	80			12.2	24.4	12.2	48.8			12.2	16.3	12.2	40.6
5	20	126	63	15.2	30.4	15.2	60.8	99	63	15.2	20.3	15.2	50.7
	40			15.2	30.5	15.2	60.9			15.2	20.3	15.2	50.7
	60			15.2	30.5	15.2	60.9			15.2	20.3	15.2	50.8
	80			15.2	30.6	15.2	61.0			15.2	20.4	15.2	50.8
10	20	189	125	30.4	60.8	30.4	121.6	161	125	30.4	40.6	30.4	101.4
	40			30.4	60.9	30.4	121.8			30.4	40.6	30.4	101.4
	60			30.4	61.0	30.4	121.9			30.4	40.7	30.4	101.5
	80			30.4	61.1	30.5	122.0			30.4	40.7	30.5	101.6
15	20	247	192	45.6	91.3	45.6	182.4	224	188	45.6	60.8	45.6	152.0
	40			45.6	91.4	45.6	182.6			45.6	60.9	45.6	152.2
	60			45.6	91.5	45.7	182.8			45.6	61.0	45.7	152.3
	80			45.6	91.7	45.7	183.0			45.6	61.1	45.7	152.4



## 20 CHARACTER DATA RECORD

1410/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	1	1	.6	.0	.3	.9	1	1	.7	.0	.2	.9
	10			.7	.0	.3	.9			.7	.0	.2	.9
	15			.7	.0	.3	.9			.8	.0	.2	1.0
10	5	2	1	1.3	.5	.4	2.2	1	1	1.4	.0	.5	1.9
	10			1.4	.5	.4	2.3			1.5	.0	.5	1.9
	15			1.4	.5	.4	2.4			1.5	.0	.6	2.0
20	5	3	2	2.6	1.0	.9	4.5	4	2	2.8	1.1	.8	4.6
	10			2.7	1.1	.9	4.7			2.9	1.2	.8	4.9
	15			2.9	1.1	1.0	4.9			3.1	1.2	.8	5.1
30	5	4	3	3.9	1.5	1.5	6.9	6	3	4.2	1.7	1.1	7.0
	10			4.1	1.6	1.5	7.2			4.4	1.8	1.2	7.3
	15			4.3	1.6	1.6	7.5			4.6	1.8	1.2	7.6
40	5	5	4	5.2	2.0	2.1	9.3	7	4	5.5	2.2	1.8	9.5
	10			5.5	2.1	2.2	9.7			5.8	2.3	1.8	10.0
	15			5.7	2.2	2.3	10.2			6.1	2.5	1.9	10.5
50	5	13	5	6.5	5.0	1.9	13.4	8	5	6.9	2.8	2.2	11.9
	10			6.8	5.3	1.9	14.0			7.3	2.9	2.3	12.5
	15			7.1	5.5	2.0	14.6			7.6	3.1	2.4	13.1
75	5	15	7	9.7	7.6	2.8	20.1	10	7	10.4	4.2	3.7	18.3
	10			10.2	7.9	2.9	21.0			10.9	4.4	3.8	19.2
	15			10.7	8.2	3.0	21.9			11.5	4.6	4.0	20.1
100	5	17	9	13.0	10.1	4.4	27.5	12	9	13.8	5.6	4.9	24.3
	10			13.6	10.5	4.6	28.8			14.6	5.9	5.1	25.5
	15			14.3	11.0	4.8	30.0			15.3	6.1	5.3	26.8
125	5	20	12	16.2	12.6	5.5	34.4	15	12	17.3	7.0	6.5	30.8
	10			17.0	13.2	5.7	35.9			18.2	7.3	6.8	32.3
	15			17.8	13.7	5.9	37.5			19.1	7.7	7.1	33.9
150	5	22	14	19.5	15.1	6.6	41.3	17	14	20.8	8.4	8.4	37.5
	10			20.5	15.8	6.9	43.1			21.8	8.8	8.8	39.4
	15			21.4	16.5	7.1	45.0			22.9	9.2	9.2	41.3
175	5	24	16	22.7	17.6	7.7	48.1	19	16	24.2	9.8	9.8	43.8
	10			23.9	18.4	8.0	50.3			25.5	10.3	10.2	46.0
	15			25.0	19.2	8.3	52.5			26.7	10.7	10.7	48.2
200	5	26	18	26.0	20.2	9.8	56.0	21	18	27.7	11.2	11.2	50.0
	10			27.3	21.1	10.2	58.6			29.1	11.7	11.7	52.6
	15			28.5	22.0	10.7	61.2			30.6	12.3	12.3	55.1
250	5	31	23	32.5	25.2	12.3	70.0	59	23	34.6	28.1	9.4	72.1
	10			34.1	26.3	12.8	73.2			36.4	29.5	9.7	75.6
	15			35.7	27.5	13.3	76.5			38.2	30.8	10.0	79.0
300	5	35	27	39.0	30.2	15.5	84.8	63	27	41.5	33.7	11.3	86.5
	10			40.9	31.6	16.3	88.8			43.7	35.4	11.7	90.7
	15			42.8	32.9	17.0	92.7			45.9	37.0	12.0	94.9
350	5	40	32	45.5	35.3	18.1	98.9	68	32	48.4	39.3	13.2	101.0
	10			47.7	36.9	19.0	103.5			51.0	41.2	13.6	105.8
	15			50.0	38.4	19.8	108.2			53.5	43.2	14.0	110.7
400	5	72	36	52.0	61.0	15.1	128.1	72	36	55.3	45.0	15.1	115.4
	10			54.5	63.6	15.6	133.7			58.2	47.1	15.6	120.9
	15			57.1	66.3	16.0	139.4			61.1	49.3	16.0	126.5

## 30 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.2	1.2	1	1	.7	.0	.3	.9
	10			.7	.3	.2	1.2			.7	.0	.3	1.0
	15			.7	.3	.2	1.3			.8	.0	.3	1.0
	20			.8	.3	.2	1.3			.8	.0	.3	1.1
10	5	3	2	1.4	.6	.5	2.4	2	1	1.4	.0	.6	2.0
	10			1.4	.6	.5	2.5			1.5	.0	.7	2.1
	15			1.5	.6	.5	2.6			1.5	.0	.7	2.2
	20			1.6	.6	.5	2.7			1.6	.0	.7	2.3
20	5	4	3	2.7	1.1	1.1	5.0	6	3	2.8	1.3	.9	4.9
	10			2.9	1.2	1.1	5.2			2.9	1.3	.9	5.1
	15			3.0	1.2	1.2	5.4			3.1	1.4	.9	5.3
	20			3.1	1.3	1.2	5.6			3.2	1.4	.9	5.5
30	5	13	5	4.1	3.5	1.3	8.9	8	5	4.2	1.9	1.5	7.6
	10			4.3	3.6	1.3	9.2			4.4	2.0	1.5	7.9
	15			4.5	3.7	1.4	9.6			4.6	2.1	1.6	8.2
	20			4.7	3.9	1.4	9.9			4.8	2.1	1.6	8.6
40	5	14	6	5.5	4.6	1.7	11.8	9	6	5.6	2.5	2.0	10.1
	10			5.7	4.8	1.8	12.3			5.8	2.6	2.1	10.6
	15			6.0	5.0	1.8	12.8			6.1	2.8	2.1	11.0
	20			6.2	5.2	1.8	13.2			6.4	2.9	2.2	11.4
50	5	15	7	6.9	5.8	2.1	14.8	10	7	7.0	3.2	2.8	12.9
	10			7.2	6.0	2.2	15.4			7.3	3.3	2.9	13.5
	15			7.5	6.2	2.3	16.0			7.6	3.4	3.0	14.0
	20			7.8	6.5	2.3	16.5			8.0	3.6	3.1	14.6
75	5	19	11	10.3	8.7	3.7	22.7	14	11	10.5	4.7	4.3	19.5
	10			10.7	9.0	3.9	23.6			11.0	5.0	4.5	20.4
	15			11.2	9.3	4.0	24.5			11.5	5.2	4.7	21.3
	20			11.7	9.7	4.1	25.5			12.0	5.4	4.9	22.2
100	5	22	14	13.7	11.6	5.0	30.3	17	14	13.9	6.3	6.2	26.5
	10			14.3	12.0	5.2	31.5			14.6	6.6	6.5	27.7
	15			14.9	12.5	5.3	32.7			15.3	6.9	6.8	28.9
	20			15.5	12.9	5.5	33.9			16.0	7.2	7.0	30.2
125	5	25	17	17.2	14.5	6.9	38.5	20	17	17.4	7.9	7.8	33.1
	10			17.9	15.0	7.1	40.1			18.3	8.3	8.1	34.6
	15			18.7	15.6	7.4	41.6			19.1	8.6	8.5	36.2
	20			19.4	16.1	7.7	43.2			20.0	8.9	8.8	37.7
150	5	29	21	20.6	17.3	8.2	46.2	57	21	20.9	19.2	6.4	46.5
	10			21.5	18.0	8.6	48.1			21.9	20.0	6.6	48.5
	15			22.4	18.7	8.9	50.0			22.9	20.8	6.8	50.5
	20			23.3	19.4	9.2	51.9			23.9	21.6	6.9	52.5
175	5	32	24	24.0	20.2	9.6	53.9	60	24	24.4	22.4	7.5	54.2
	10			25.1	21.0	10.0	56.1			25.6	23.3	7.7	56.6
	15			26.1	21.8	10.4	58.3			26.8	24.3	7.9	58.9
	20			27.2	22.6	10.7	60.5			27.9	25.2	8.1	61.2
200	5	35	27	27.4	23.1	11.6	62.1	63	27	27.9	25.6	8.6	62.0
	10			28.7	24.0	12.0	64.7			29.2	26.6	8.8	64.7
	15			29.9	24.9	12.5	67.3			30.6	27.7	9.0	67.3
	20			31.1	25.8	13.0	69.9			31.9	28.8	9.2	70.0
250	5	68	34	34.3	44.0	10.7	89.0	70	34	34.9	32.0	10.7	77.5
	10			35.8	45.6	11.0	92.4			36.5	33.3	11.0	80.8
	15			37.3	47.3	11.3	95.9			38.2	34.7	11.3	84.2
	20			38.9	49.0	11.5	99.4			39.9	36.0	11.5	87.5
300	5	82	41	41.2	52.8	12.8	106.8	77	41	41.8	38.3	15.1	95.3
	10			43.0	54.8	13.2	110.9			43.8	40.0	15.6	99.5
	15			44.8	56.8	13.5	115.1			45.9	41.6	16.2	103.6
	20			46.6	58.7	13.9	119.2			47.9	43.2	16.7	107.8
350	5	96	48	48.0	61.6	15.0	124.6	84	48	48.8	44.7	17.7	111.2
	10			50.2	63.9	15.4	129.4			51.2	46.6	18.2	116.0
	15			52.3	66.2	15.8	134.3			53.5	48.5	18.8	120.9
	20			54.4	68.5	16.2	139.1			55.9	50.4	19.4	125.8
400	5	108	54	54.9	70.4	17.1	142.4	90	54	55.8	51.1	20.2	127.1
	10			57.3	73.0	17.6	147.9			58.5	53.3	20.9	132.6
	15			59.8	75.7	18.0	153.4			61.2	55.5	21.5	138.2
	20			62.2	78.3	18.5	159.0			63.9	57.6	22.2	143.7

## 60K CCORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.2	1.3	1	1	.7	.0	.3	1.0
	10			.7	.3	.2	1.3			.7	.0	.3	1.0
	15			.8	.3	.3	1.4			.8	.0	.3	1.1
	20			.8	.4	.3	1.4			.8	.0	.4	1.1
10	5	3	2	1.4	.6	.6	2.6	4	2	1.4	.7	.5	2.6
	10			1.5	.7	.6	2.7			1.5	.7	.5	2.7
	15			1.5	.7	.6	2.8			1.6	.8	.5	2.8
	20			1.6	.7	.6	2.9			1.6	.8	.5	2.9
20	5	5	4	2.8	1.3	1.3	5.4	7	4	2.8	1.4	1.1	5.4
	10			2.9	1.3	1.3	5.6			3.0	1.5	1.1	5.6
	15			3.1	1.4	1.4	5.8			3.1	1.5	1.2	5.8
	20			3.2	1.4	1.4	6.0			3.2	1.6	1.2	6.0
30	5	14	6	4.2	3.9	1.4	9.6	9	6	4.3	2.1	1.7	8.1
	10			4.4	4.0	1.5	9.9			4.5	2.2	1.7	8.4
	15			4.6	4.2	1.5	10.3			4.7	2.3	1.8	8.7
	20			4.8	4.3	1.5	10.6			4.8	2.4	1.8	9.0
40	5	16	8	5.6	5.2	1.9	12.8	11	8	5.7	2.8	2.4	11.0
	10			5.9	5.4	2.0	13.2			5.9	2.9	2.5	11.4
	15			6.1	5.6	2.0	13.7			6.2	3.0	2.6	11.9
	20			6.3	5.7	2.0	14.1			6.5	3.2	2.7	12.3
50	5	17	9	7.1	6.5	2.8	16.3	12	9	7.1	3.5	3.0	13.7
	10			7.4	6.7	2.9	16.9			7.4	3.7	3.2	14.3
	15			7.6	7.0	2.9	17.5			7.8	3.8	3.3	14.8
	20			7.9	7.2	3.0	18.1			8.1	3.9	3.4	15.4
75	5	22	14	10.6	9.8	4.2	24.5	17	14	10.7	5.3	5.1	21.1
	10			11.0	10.1	4.3	25.4			11.2	5.5	5.3	22.0
	15			11.5	10.4	4.4	26.3			11.6	5.7	5.5	22.9
	20			11.9	10.8	4.5	27.2			12.1	5.9	5.8	23.8
100	5	26	18	14.1	13.0	6.1	33.2	21	18	14.2	7.1	6.8	28.1
	10			14.7	13.5	6.3	34.5			14.9	7.3	7.1	29.3
	15			15.3	13.9	6.5	35.7			15.5	7.6	7.4	30.5
	20			15.9	14.4	6.7	37.0			16.1	7.9	7.7	31.7
125	5	31	23	17.7	16.3	7.6	41.5	59	23	17.8	17.9	6.0	41.7
	10			18.4	16.8	7.9	43.1			18.6	18.6	6.1	43.3
	15			19.1	17.4	8.1	44.6			19.4	19.3	6.3	44.9
	20			19.8	18.0	8.4	46.2			20.2	19.9	6.4	46.5
150	5	35	27	21.2	19.5	9.6	50.3	63	27	21.3	21.5	7.2	50.0
	10			22.1	20.2	9.9	52.2			22.3	22.3	7.3	51.9
	15			22.9	20.9	10.3	54.1			23.3	23.1	7.5	53.9
	20			23.8	21.6	10.6	56.0			24.2	23.9	7.7	55.8
175	5	40	32	24.7	22.8	11.2	58.7	68	32	24.9	25.1	8.4	58.3
	10			25.7	23.6	11.6	60.9			26.0	26.0	8.6	60.6
	15			26.8	24.4	12.0	63.1			27.1	27.0	8.8	62.8
	20			27.8	25.2	12.4	65.3			28.2	27.9	9.0	65.1
200	5	72	36	28.2	39.9	9.5	77.7	72	36	28.5	28.6	9.5	66.7
	10			29.4	41.2	9.8	80.4			29.7	29.7	9.8	69.2
	15			30.6	42.5	10.0	83.1			31.0	30.8	10.0	71.8
	20			31.7	43.8	10.2	85.8			32.3	31.9	10.2	74.4
250	5	90	45	35.3	49.9	11.9	97.1	81	45	35.6	35.8	14.1	85.5
	10			36.8	51.5	12.2	100.5			37.2	37.2	14.5	88.9
	15			38.2	53.1	12.5	103.9			38.8	38.5	15.0	92.2
	20			39.7	54.8	12.8	107.3			40.4	39.9	15.4	95.6
300	5	108	54	42.4	59.8	14.3	116.5	90	54	42.7	43.0	16.9	102.6
	10			44.1	61.8	14.7	120.6			44.6	44.6	17.4	106.6
	15			45.9	63.8	15.0	124.6			46.5	46.2	17.9	110.7
	20			47.6	65.8	15.3	128.7			48.4	47.8	18.5	114.7
350	5	126	63	49.4	69.8	16.7	136.0	99	63	49.8	50.1	19.8	119.7
	10			51.5	72.1	17.1	140.7			52.0	52.0	20.3	124.4
	15			53.5	74.4	17.5	145.4			54.3	53.9	20.9	129.1
	20			55.5	76.7	17.9	150.2			56.5	55.8	21.5	133.8
400	5	136	72	56.5	79.8	22.5	158.8	108	72	56.9	57.3	22.6	136.8
	10			58.8	82.4	23.2	164.4			59.5	59.4	23.3	142.2
	15			61.1	85.0	23.8	170.0			62.0	61.6	23.9	147.6
	20			63.5	87.7	24.5	175.7			64.6	63.8	24.6	152.9

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.3	1.4		2	1	.8	.0	.4	1.1
	20			.8	.4	.3	1.5				.8	.0	.4	1.2
	30			.9	.4	.3	1.6				.9	.0	.4	1.3
	40			.9	.4	.4	1.7				1.0	.0	.4	1.4
10	10	4	3	1.5	.7	.7	2.9		6	3	1.5	.8	.5	2.9
	20			1.6	.8	.7	3.1				1.7	.9	.6	3.1
	30			1.7	.8	.8	3.3				1.8	.9	.6	3.3
	40			1.9	.9	.8	3.5				1.9	1.0	.6	3.5
20	10	13	5	3.0	3.0	1.1	7.1		8	5	3.1	1.6	1.3	6.0
	20			3.3	3.2	1.1	7.5				3.3	1.7	1.3	6.4
	30			3.5	3.3	1.2	8.0				3.6	1.8	1.4	6.8
	40			3.7	3.5	1.2	8.4				3.8	1.9	1.5	7.2
30	10	15	7	4.5	4.5	1.6	10.6		10	7	4.6	2.4	2.1	9.1
	20			4.9	4.8	1.7	11.3				5.0	2.6	2.2	9.8
	30			5.2	5.0	1.8	12.0				5.4	2.7	2.3	10.5
	40			5.6	5.3	1.8	12.7				5.8	2.9	2.5	11.1
40	10	17	9	6.1	6.0	2.5	14.6		12	9	6.2	3.2	2.8	12.2
	20			6.5	6.3	2.6	15.5				6.7	3.4	2.9	13.1
	30			7.0	6.7	2.8	16.4				7.2	3.7	3.1	14.0
	40			7.4	7.1	2.9	17.4				7.7	3.9	3.3	14.8
50	10	20	12	7.6	7.5	3.1	18.2		15	12	7.7	4.0	3.6	15.4
	20			8.1	7.9	3.3	19.4				8.4	4.3	3.9	16.5
	30			8.7	8.4	3.5	20.6				9.0	4.6	4.1	17.6
	40			9.3	8.8	3.6	21.7				9.6	4.9	4.3	18.8
75	10	25	17	11.4	11.2	5.2	27.7		20	17	11.6	6.1	5.4	23.1
	20			12.2	11.9	5.5	29.6				12.5	6.5	5.8	24.8
	30			13.0	12.6	5.8	31.4				13.5	6.9	6.1	26.5
	40			13.9	13.2	6.1	33.3				14.4	7.3	6.5	28.2
100	10	31	23	15.1	15.0	6.9	37.0		59	23	15.5	16.4	5.4	37.3
	20			16.3	15.9	7.3	39.4				16.7	17.5	5.6	39.8
	30			17.4	16.7	7.7	41.9				17.9	18.6	5.8	42.4
	40			18.5	17.6	8.2	44.3				19.2	19.7	6.1	44.9
125	10	36	28	18.9	18.7	9.0	46.6		64	28	19.4	20.5	6.7	46.6
	20			20.3	19.8	9.6	49.8				20.9	21.9	7.0	49.8
	30			21.7	20.9	10.2	52.9				22.4	23.2	7.3	53.0
	40			23.2	22.1	10.8	56.0				24.0	24.6	7.6	56.1
150	10	68	34	22.7	34.5	8.1	65.3		70	34	23.2	24.6	8.1	56.0
	20			24.4	36.5	8.4	69.3				25.1	26.3	8.4	59.8
	30			26.1	38.4	8.8	73.3				26.9	27.9	8.8	63.6
	40			27.8	40.4	9.1	77.3				28.8	29.5	9.1	67.4
175	10	80	40	26.5	40.3	9.4	76.2		76	40	27.1	28.8	11.2	67.1
	20			28.5	42.5	9.8	80.8				29.3	30.6	11.8	71.7
	30			30.4	44.8	10.2	85.5				31.4	32.5	12.4	76.3
	40			32.4	47.1	10.6	90.2				33.6	34.4	13.0	81.0
200	10	90	45	30.3	46.0	10.8	87.1		81	45	31.0	32.9	12.8	76.7
	20			32.5	48.6	11.2	92.4				33.4	35.0	13.5	82.0
	30			34.8	51.2	11.7	97.7				35.9	37.2	14.2	87.3
	40			37.0	53.9	12.1	103.0				38.4	39.3	14.9	92.6
250	10	112	56	37.9	57.5	13.5	108.8		92	56	38.7	41.1	16.0	95.8
	20			40.7	60.8	14.0	115.5				41.8	43.8	16.9	102.5
	30			43.5	64.0	14.6	122.1				44.9	46.5	17.7	109.1
	40			46.3	67.3	15.2	128.8				47.9	49.2	18.6	115.7
300	10	131	67	45.4	69.0	19.1	133.6		103	67	46.5	49.3	19.3	115.0
	20			48.8	72.9	20.2	141.9				50.2	52.5	20.3	122.9
	30			52.2	76.8	21.2	150.2				53.8	55.7	21.3	130.9
	40			55.6	80.8	22.2	158.6				57.5	59.0	22.3	138.8
350	10	143	79	53.0	80.5	22.3	155.9		115	79	54.2	57.5	25.0	136.7
	20			57.0	85.1	23.5	165.6				58.5	61.3	26.5	146.3
	30			60.9	89.6	24.7	175.3				62.8	65.0	28.0	155.9
	40			64.8	94.3	25.9	185.0				67.1	68.8	29.5	165.4
400	10	154	90	60.6	92.0	25.5	178.1		126	90	62.0	65.7	28.6	156.3
	20			65.1	97.2	26.9	189.2				66.9	70.0	30.3	167.2
	30			69.6	102.5	28.3	200.3				71.8	74.3	32.0	178.1
	40			74.1	107.7	29.6	211.4				76.7	78.6	33.7	189.1

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.3	1.5	2	1	.8	.0	.4	1.2
	20			.8	.4	.4	1.6			.9	.0	.4	1.3
	30			.9	.5	.4	1.7			.9	.0	.5	1.4
	40			.9	.5	.4	1.8			1.0	.0	.5	1.4
10	10	4	3	1.6	.8	.7	3.1	6	3	1.6	.9	.6	3.1
	20			1.7	.9	.8	3.3			1.7	.9	.6	3.3
	30			1.8	.9	.8	3.5			1.9	1.0	.6	3.5
	40			1.9	1.0	.9	3.7			2.0	1.1	.7	3.7
20	10	14	6	3.1	3.3	1.2	7.6	9	6	3.2	1.8	1.4	6.4
	20			3.3	3.5	1.2	8.0			3.5	1.9	1.4	6.8
	30			3.5	3.7	1.3	8.5			3.7	2.0	1.5	7.2
	40			3.8	3.8	1.3	8.9			4.0	2.1	1.6	7.7
30	10	17	9	4.7	5.0	2.1	11.7	12	9	4.9	2.7	2.3	9.8
	20			5.0	5.2	2.2	12.4			5.2	2.8	2.4	10.4
	30			5.3	5.5	2.3	13.1			5.6	3.0	2.5	11.1
	40			5.6	5.8	2.4	13.8			6.0	3.2	2.7	11.8
40	10	19	11	6.2	6.6	2.7	15.6	14	11	6.5	3.5	3.2	13.2
	20			6.7	7.0	2.9	16.5			7.0	3.8	3.3	14.1
	30			7.1	7.3	3.0	17.4			7.5	4.0	3.5	15.0
	40			7.5	7.7	3.2	18.4			7.9	4.2	3.7	15.9
50	10	22	14	7.8	8.3	3.4	19.5	17	14	8.1	4.4	4.2	16.8
	20			8.3	8.7	3.6	20.6			8.7	4.7	4.5	17.9
	30			8.9	9.2	3.8	21.8			9.3	5.0	4.8	19.1
	40			9.4	9.6	3.9	22.9			9.9	5.3	5.1	20.2
75	10	29	21	11.7	12.4	5.6	29.7	57	21	12.1	13.6	4.4	30.2
	20			12.5	13.1	6.0	31.5			13.1	14.4	4.6	32.1
	30			13.3	13.7	6.3	33.3			14.0	15.2	4.8	33.9
	40			14.1	14.4	6.6	35.1			14.9	16.0	4.9	35.8
100	10	36	28	15.6	16.5	7.8	40.0	64	28	16.2	18.1	5.9	40.2
	20			16.6	17.4	8.3	42.4			17.4	19.2	6.1	42.7
	30			17.7	18.3	8.8	44.8			18.6	20.3	6.4	45.2
	40			18.8	19.2	9.3	47.3			19.8	21.3	6.6	47.8
125	10	68	34	19.5	32.0	7.4	58.8	70	34	20.2	22.7	7.4	50.3
	20			20.8	33.6	7.7	62.1			21.8	24.0	7.7	53.4
	30			22.1	35.2	8.0	65.3			23.3	25.3	8.0	56.6
	40			23.5	36.9	8.2	68.6			24.8	26.7	8.2	59.7
150	10	82	41	23.4	38.4	8.9	70.6	77	41	24.3	27.2	10.6	62.1
	20			25.0	40.3	9.2	74.5			26.1	28.8	11.1	66.0
	30			26.6	42.3	9.5	78.4			27.9	30.4	11.6	70.0
	40			28.2	44.2	9.9	82.3			29.8	32.0	12.1	73.9
175	10	96	48	27.3	44.8	10.3	82.4	84	48	28.3	31.7	12.4	72.4
	20			29.1	47.0	10.7	86.9			30.5	33.6	13.0	77.0
	30			31.0	49.3	11.1	91.4			32.6	35.4	13.6	81.6
	40			32.8	51.6	11.5	96.0			34.7	37.3	14.2	86.2
200	10	110	55	31.1	51.2	11.8	94.2	91	55	32.4	36.3	14.1	82.8
	20			33.3	53.8	12.3	99.3			34.8	38.4	14.8	88.0
	30			35.4	56.4	12.7	104.5			37.3	40.5	15.5	93.3
	40			37.5	59.0	13.2	109.7			39.7	42.7	16.2	98.5
250	10	132	68	38.9	64.0	17.5	120.5	104	68	40.5	45.3	17.7	103.5
	20			41.6	67.2	18.4	127.2			43.5	48.0	18.5	110.0
	30			44.3	70.5	19.2	134.0			46.6	50.6	19.4	116.6
	40			46.9	73.7	20.1	140.7			49.6	53.3	20.2	123.2
300	10	146	82	46.7	76.8	21.1	144.6	118	82	48.6	54.4	23.6	126.6
	20			49.9	80.7	22.1	152.6			52.2	57.6	24.9	134.7
	30			53.1	84.5	23.1	160.7			55.9	60.8	26.2	142.9
	40			56.3	88.4	24.1	168.9			59.5	64.0	27.5	151.0
350	10	160	96	54.5	89.6	24.6	168.7	132	96	56.7	63.4	27.6	147.7
	20			58.2	94.1	25.8	178.1			60.9	67.2	29.1	157.2
	30			62.0	98.6	26.9	187.5			65.2	70.9	30.6	166.7
	40			65.7	103.2	28.1	197.0			69.5	74.7	32.1	176.2
400	10	173	109	62.3	102.4	28.1	192.8	145	109	64.8	72.5	32.8	170.1
	20			66.5	107.5	29.4	203.5			69.7	76.8	34.7	181.1
	30			70.8	112.7	30.8	214.3			74.5	81.0	36.5	192.1
	40			75.1	117.9	32.2	225.2			79.4	85.3	38.4	203.1

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.4	1.6		4	2	.8	.5	.3	1.6
	20			.9	.5	.4	1.7				.9	.5	.3	1.7
	30			.9	.5	.4	1.8				1.0	.5	.3	1.8
	40			1.0	.5	.4	1.9				1.0	.6	.4	1.9
10	10	5	4	1.6	.9	.8	3.3		7	4	1.7	1.0	.7	3.3
	20			1.7	.9	.9	3.5				1.8	1.0	.7	3.5
	30			1.8	1.0	.9	3.7				1.9	1.1	.8	3.7
	40			1.9	1.0	1.0	3.9				2.0	1.1	.8	4.0
20	10	15	7	3.2	3.6	1.3	8.1		10	7	3.3	1.9	1.6	6.9
	20			3.5	3.8	1.3	8.5				3.6	2.0	1.7	7.3
	30			3.7	3.9	1.4	9.0				3.8	2.1	1.8	7.7
	40			3.9	4.1	1.4	9.4				4.1	2.2	1.9	8.2
30	10	18	10	4.9	5.4	2.2	12.5		13	10	5.0	2.9	2.5	10.4
	20			5.2	5.6	2.3	13.2				5.4	3.0	2.7	11.1
	30			5.5	5.9	2.4	13.9				5.7	3.2	2.8	11.7
	40			5.8	6.2	2.5	14.5				6.1	3.4	3.0	12.4
40	10	21	13	6.5	7.2	3.0	16.6		16	13	6.7	3.8	3.6	14.1
	20			6.9	7.5	3.1	17.6				7.1	4.0	3.9	15.0
	30			7.3	7.9	3.2	18.5				7.6	4.3	4.1	16.0
	40			7.8	8.2	3.4	19.4				8.1	4.5	4.3	16.9
50	10	24	16	8.1	9.0	3.7	20.8		19	16	8.3	4.8	4.5	17.7
	20			8.6	9.4	3.9	21.9				8.9	5.1	4.8	18.8
	30			9.2	9.9	4.0	23.1				9.5	5.3	5.1	19.9
	40			9.7	10.3	4.2	24.2				10.1	5.6	5.4	21.1
75	10	32	24	12.2	13.5	6.1	31.7		60	24	12.5	14.7	4.8	32.0
	20			13.0	14.1	6.4	33.5				13.4	15.5	5.0	33.9
	30			13.8	14.8	6.7	35.3				14.3	16.3	5.1	35.7
	40			14.6	15.5	7.0	37.1				15.2	17.1	5.3	37.6
100	10	40	32	16.2	17.9	8.4	42.6		68	32	16.7	19.6	6.4	42.7
	20			17.3	18.8	8.9	45.0				17.9	20.7	6.6	45.2
	30			18.4	19.7	9.4	47.5				19.1	21.7	6.8	47.6
	40			19.4	20.6	9.8	49.9				20.3	22.8	7.1	50.1
125	10	80	40	20.3	34.9	8.0	63.1		76	40	20.8	24.5	9.6	54.9
	20			21.6	36.4	8.3	66.3				22.3	25.8	10.0	58.2
	30			23.0	38.1	8.6	69.6				23.8	27.2	10.4	61.4
	40			24.3	39.7	8.8	72.8				25.3	28.5	10.9	64.7
150	10	94	47	24.3	41.8	9.6	75.8		83	47	25.0	29.4	11.5	65.9
	20			25.9	43.7	9.9	79.6				26.8	31.0	12.0	69.8
	30			27.5	45.7	10.3	83.5				28.6	32.6	12.5	73.7
	40			29.1	47.6	10.6	87.4				30.4	34.2	13.0	77.6
175	10	110	55	28.4	48.8	11.2	88.4		91	55	29.2	34.3	13.4	76.9
	20			30.3	51.0	11.6	92.9				31.3	36.2	14.0	81.4
	30			32.1	53.3	12.0	97.4				33.4	38.0	14.6	86.0
	40			34.0	55.5	12.4	101.9				35.4	39.9	15.2	90.5
200	10	126	63	32.5	55.8	12.8	101.0		99	63	33.4	39.2	15.3	87.9
	20			34.6	58.3	13.2	106.1				35.7	41.3	16.0	93.1
	30			36.7	60.9	13.7	111.3				38.1	43.5	16.7	98.3
	40			38.9	63.5	14.1	116.5				40.5	45.6	17.4	103.5
250	10	143	79	40.6	69.7	19.0	129.3		115	79	41.7	49.0	21.4	112.1
	20			43.2	72.9	19.8	136.0				44.7	51.7	22.4	118.8
	30			45.9	76.1	20.7	142.7				47.7	54.3	23.5	125.5
	40			48.6	79.3	21.5	149.5				50.6	57.0	24.6	132.2
300	10	158	94	48.7	83.7	22.8	155.1		130	94	50.0	58.9	25.6	134.5
	20			51.9	87.5	23.8	163.2				53.6	62.0	26.9	142.5
	30			55.1	91.3	24.8	171.3				57.2	65.2	28.2	150.6
	40			58.3	95.2	25.9	179.3				60.8	68.4	29.5	158.7
350	10	174	110	56.8	97.6	26.6	181.0		146	110	58.4	68.7	31.0	158.0
	20			60.5	102.1	27.8	190.4				62.5	72.4	32.7	167.6
	30			64.3	106.5	29.0	199.8				66.7	76.1	34.3	177.1
	40			68.0	111.1	30.2	209.2				70.9	79.8	36.0	186.7
400	10	189	125	64.9	111.5	30.4	206.9		161	125	66.7	78.5	35.4	180.6
	20			69.2	116.6	31.7	217.6				71.5	82.7	37.3	191.5
	30			73.5	121.8	33.1	228.3				76.3	86.9	39.2	202.4
	40			77.7	126.9	34.5	239.1				81.0	91.2	41.1	213.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.5	.4	1.7	4	2	.9	.5	.3	1.7
	20			.9	.5	.4	1.8			.9	.5	.4	1.8
	30			.9	.5	.4	1.9			1.0	.6	.4	1.9
	40			1.0	.5	.4	2.0			1.0	.6	.4	2.0
10	10	5	4	1.7	1.0	.9	3.5	7	4	1.7	1.0	.8	3.5
	20			1.8	1.0	.9	3.7			1.8	1.1	.8	3.8
	30			1.9	1.0	1.0	3.9			1.9	1.1	.9	4.0
	40			2.0	1.1	1.0	4.1			2.1	1.2	.9	4.2
20	10	16	8	3.3	3.9	1.4	8.6	11	8	3.4	2.1	1.7	7.2
	20			3.5	4.1	1.4	9.0			3.7	2.2	1.8	7.7
	30			3.7	4.2	1.5	9.5			3.9	2.3	1.9	8.1
	40			3.9	4.4	1.5	9.9			4.1	2.4	2.0	8.5
30	10	19	11	5.0	5.8	2.4	13.2	14	11	5.1	3.1	2.7	11.0
	20			5.3	6.1	2.5	13.9			5.5	3.3	2.9	11.6
	30			5.6	6.4	2.6	14.6			5.8	3.4	3.0	12.3
	40			5.9	6.6	2.7	15.3			6.2	3.6	3.2	12.9
40	10	23	15	6.7	7.8	3.2	17.6	18	15	6.9	4.1	3.9	14.9
	20			7.1	8.1	3.3	18.5			7.3	4.3	4.1	15.8
	30			7.5	8.5	3.5	19.4			7.8	4.6	4.3	16.7
	40			7.9	8.8	3.6	20.3			8.3	4.8	4.6	17.6
50	10	26	18	8.3	9.7	4.3	22.4	21	18	8.6	5.2	4.9	18.6
	20			8.9	10.2	4.6	23.6			9.2	5.4	5.1	19.7
	30			9.4	10.6	4.8	24.7			9.7	5.7	5.4	20.9
	40			9.9	11.1	5.0	25.9			10.3	6.0	5.7	22.0
75	10	35	27	12.5	14.6	6.8	33.9	63	27	12.9	15.9	5.2	34.0
	20			13.3	15.2	7.1	35.6			13.7	16.7	5.3	35.8
	30			14.0	15.9	7.5	37.4			14.6	17.5	5.5	37.6
	40			14.8	16.6	7.8	39.2			15.5	18.3	5.7	39.5
100	10	72	36	16.7	30.4	6.9	53.9	72	36	17.2	21.2	6.9	45.3
	20			17.7	31.6	7.1	56.4			18.3	22.3	7.1	47.7
	30			18.7	32.9	7.3	58.9			19.5	23.3	7.3	50.2
	40			19.7	34.2	7.6	61.5			20.7	24.4	7.6	52.6
125	10	90	45	20.9	37.9	8.6	67.4	81	45	21.5	26.5	10.4	58.3
	20			22.1	39.5	8.9	70.5			22.9	27.8	10.8	61.5
	30			23.4	41.1	9.2	73.7			24.4	29.2	11.2	64.7
	40			24.7	42.7	9.5	76.8			25.8	30.5	11.6	68.0
150	10	108	54	25.0	45.5	10.3	80.9	90	54	25.7	31.8	12.4	70.0
	20			26.6	47.4	10.7	84.6			27.5	33.4	12.9	73.8
	30			28.1	49.3	11.0	88.4			29.2	35.0	13.5	77.7
	40			29.6	51.3	11.4	92.2			31.0	36.6	14.0	81.5
175	10	126	63	29.2	53.1	12.0	94.4	99	63	30.0	37.2	14.5	81.7
	20			31.0	55.3	12.4	98.8			32.1	39.0	15.1	86.2
	30			32.8	57.6	12.9	103.2			34.1	40.8	15.7	90.6
	40			34.5	59.8	13.3	107.6			36.2	42.7	16.3	95.1
200	10	136	72	33.4	60.7	16.4	110.5	108	72	34.3	42.5	16.6	93.4
	20			35.4	63.2	17.1	115.7			36.7	44.6	17.3	98.5
	30			37.4	65.8	17.8	121.0			39.0	46.7	17.9	103.6
	40			39.5	68.3	18.5	126.3			41.3	48.8	18.6	108.7
250	10	154	90	41.7	75.9	20.5	138.1	126	90	42.9	53.1	23.1	119.1
	20			44.3	79.0	21.4	144.7			45.8	55.7	24.2	125.7
	30			46.8	82.2	22.2	151.2			48.7	58.3	25.3	132.3
	40			49.3	85.4	23.1	157.8			51.6	61.0	26.4	139.0
300	10	172	108	50.1	91.1	24.6	165.7	144	108	51.5	63.7	27.8	142.9
	20			53.1	94.8	25.6	173.6			55.0	66.8	29.1	150.9
	30			56.2	98.7	26.7	181.5			58.5	70.0	30.3	158.8
	40			59.2	102.5	27.7	189.4			62.0	73.2	31.6	166.8
350	10	189	125	58.4	106.2	28.7	193.4	161	125	60.1	74.3	33.5	167.9
	20			62.0	110.7	29.9	202.5			64.1	78.0	35.2	177.3
	30			65.5	115.1	31.1	211.7			68.2	81.7	36.8	186.7
	40			69.1	119.6	32.3	221.0			72.3	85.4	38.5	196.2
400	10	207	143	66.8	121.4	36.5	224.6	179	143	68.7	84.9	38.3	191.9
	20			70.8	126.5	38.2	235.4			73.3	89.1	40.2	202.6
	30			74.9	131.5	39.9	246.3			78.0	93.3	42.1	213.4
	40			78.9	136.7	41.6	257.2			82.6	97.6	44.0	224.2

## 90 CHARACTER DATA RECORD

1410/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED	MOD A	MOD B	SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME				PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.5	.4	1.8	6		3	.9	.6	.4	1.8
	20			.9	.5	.5	1.9				.9	.6	.4	1.9
	30			1.0	.6	.5	2.0				1.0	.6	.4	2.0
	40			1.0	.6	.5	2.1				1.0	.6	.4	2.1
10	10	13	5	1.7	2.1	.7	4.6	8		5	1.8	1.1	.9	3.7
	20			1.8	2.2	.8	4.8				1.9	1.2	.9	3.9
	30			1.9	2.3	.8	5.0				2.0	1.2	.9	4.1
	40			2.0	2.4	.8	5.2				2.1	1.3	1.0	4.3
20	10	17	9	3.5	4.2	1.7	9.4	12		9	3.5	2.2	1.9	7.6
	20			3.7	4.4	1.8	9.8				3.7	2.3	2.0	8.0
	30			3.9	4.5	1.8	10.3				4.0	2.4	2.0	8.4
	40			4.1	4.7	1.9	10.7				4.2	2.5	2.1	8.9
30	10	21	13	5.2	6.3	2.6	14.1	16		13	5.3	3.3	3.1	11.7
	20			5.5	6.6	2.7	14.7				5.6	3.5	3.2	12.3
	30			5.8	6.8	2.8	15.4				5.9	3.6	3.4	13.0
	40			6.1	7.1	2.9	16.1				6.3	3.8	3.5	13.6
40	10	25	17	7.0	8.4	3.7	19.1	20		17	7.0	4.4	4.1	15.5
	20			7.4	8.7	3.9	20.0				7.5	4.6	4.3	16.4
	30			7.8	9.1	4.1	20.9				7.9	4.9	4.5	17.3
	40			8.2	9.5	4.2	21.9				8.4	5.1	4.7	18.2
50	10	29	21	8.7	10.5	4.6	23.8	57		21	8.8	11.4	3.7	23.9
	20			9.2	10.9	4.9	25.0				9.4	12.0	3.8	25.1
	30			9.7	11.4	5.1	26.2				9.9	12.5	3.9	26.3
	40			10.2	11.8	5.3	27.3				10.5	13.0	4.0	27.5
75	10	39	31	13.0	15.7	7.2	36.0	67		31	13.2	17.2	5.5	35.9
	20			13.8	16.4	7.6	37.8				14.0	17.9	5.7	37.7
	30			14.6	17.1	7.9	39.6				14.9	18.7	5.9	39.5
	40			15.3	17.7	8.3	41.4				15.7	19.5	6.1	41.3
100	10	82	41	17.4	32.9	7.4	57.7	77		41	17.6	22.9	8.9	49.4
	20			18.4	34.2	7.6	60.2				18.7	23.9	9.3	51.9
	30			19.4	35.4	7.9	62.7				19.8	25.0	9.6	54.4
	40			20.4	36.7	8.1	65.2				21.0	26.0	10.0	56.9
125	10	102	51	21.7	41.1	9.2	72.1	87		51	22.0	28.6	11.2	61.7
	20			23.0	42.7	9.5	75.2				23.4	29.9	11.6	64.9
	30			24.3	44.3	9.8	78.4				24.8	31.2	12.0	68.0
	40			25.5	45.9	10.1	81.5				26.2	32.5	12.4	71.2
150	10	122	61	26.1	49.4	11.1	86.5	97		61	26.4	34.3	13.4	74.1
	20			27.6	51.2	11.4	90.3				28.1	35.9	13.9	77.9
	30			29.1	53.1	11.8	94.0				29.7	37.5	14.4	81.6
	40			30.7	55.0	12.1	97.8				31.4	39.0	14.9	85.4
175	10	135	71	30.4	57.6	15.5	103.5	107		71	30.8	40.1	15.6	86.4
	20			32.2	59.8	16.1	108.0				32.7	41.9	16.2	90.8
	30			34.0	62.0	16.7	112.6				34.7	43.7	16.8	95.2
	40			35.8	64.2	17.3	117.2				36.7	45.6	17.4	99.6
200	10	145	81	34.8	65.8	17.7	118.3	117		81	35.2	45.8	20.0	100.9
	20			36.8	68.3	18.4	123.5				37.4	47.9	20.8	106.1
	30			38.8	70.8	19.0	128.7				39.7	50.0	21.7	111.3
	40			40.9	73.4	19.7	134.0				41.9	52.1	22.6	116.5
250	10	165	101	43.5	82.3	22.1	147.8	137		101	43.9	57.2	25.0	126.2
	20			46.0	85.4	22.9	154.3				46.8	59.8	26.1	132.6
	30			48.6	88.5	23.8	160.9				49.6	62.4	27.1	139.1
	40			51.1	91.7	24.7	167.5				52.4	65.1	28.2	145.7
300	10	185	121	52.2	98.7	26.5	177.4	157		121	52.7	68.7	31.0	152.4
	20			55.2	102.5	27.5	185.2				56.1	71.8	32.4	160.3
	30			58.3	106.2	28.6	193.1				59.5	74.9	33.8	168.2
	40			61.3	110.0	29.6	200.9				62.9	78.1	35.2	176.2
350	10	206	142	60.9	115.2	34.4	210.4	178		142	61.5	80.1	36.1	177.8
	20			64.4	119.5	35.9	219.8				65.5	83.8	37.8	187.0
	30			68.0	123.9	37.4	229.3				69.4	87.4	39.4	196.2
	40			71.5	128.4	38.9	238.8				73.3	91.1	41.1	205.5
400	10	226	162	69.6	131.6	39.3	240.4	198		162	70.3	91.6	46.2	208.1
	20			73.6	136.6	41.0	251.2				74.8	95.7	48.5	219.0
	30			77.7	141.6	42.7	262.0				79.3	99.9	50.7	229.9
	40			81.7	146.7	44.4	272.9				83.8	104.1	52.9	240.9



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED	MOD B	SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME			PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.8	.5	.5	1.8	6	3	.9	.6	.4	1.9
	20			.8	.6	.5	1.9			1.0	.6	.4	2.0
	30			.9	.6	.5	2.0			1.0	.6	.4	2.1
	40			.9	.6	.6	2.1			1.1	.7	.4	2.2
10	10	13	5	1.6	2.2	.8	4.6	8	5	1.8	1.2	.9	3.9
	20			1.7	2.3	.8	4.8			1.9	1.2	1.0	4.1
	30			1.8	2.4	.8	5.0			2.0	1.3	1.0	4.3
	40			1.9	2.5	.9	5.2			2.2	1.3	1.0	4.5
20	10	17	9	3.2	4.5	1.8	9.5	12	9	3.6	2.4	2.0	8.0
	20			3.4	4.7	1.9	9.9			3.9	2.5	2.1	8.4
	30			3.5	4.8	2.0	10.4			4.1	2.6	2.2	8.8
	40			3.7	5.0	2.0	10.8			4.3	2.7	2.3	9.3
30	10	22	14	4.8	6.7	2.7	14.2	17	14	5.5	3.5	3.3	12.3
	20			5.0	7.0	2.8	14.9			5.8	3.7	3.5	13.0
	30			5.3	7.3	2.9	15.5			6.1	3.9	3.7	13.7
	40			5.6	7.5	3.0	16.2			6.5	4.0	3.8	14.3
40	10	26	18	6.3	9.0	4.0	19.3	21	18	7.3	4.7	4.4	16.4
	20			6.7	9.3	4.1	20.2			7.7	4.9	4.7	17.3
	30			7.1	9.7	4.3	21.1			8.2	5.2	4.9	18.2
	40			7.5	10.0	4.5	22.0			8.6	5.4	5.1	19.1
50	10	31	23	7.9	11.2	4.9	24.1	59	23	9.1	12.2	3.9	25.3
	20			8.4	11.7	5.2	25.2			9.7	12.8	4.1	26.5
	30			8.9	12.1	5.4	26.4			10.2	13.3	4.2	27.7
	40			9.3	12.6	5.6	27.5			10.8	13.8	4.3	28.9
75	10	68	34	11.9	26.5	5.9	44.3	70	34	13.7	18.4	5.9	37.9
	20			12.6	27.4	6.1	46.1			14.5	19.1	6.1	39.7
	30			13.3	28.4	6.3	47.9			15.4	19.9	6.3	41.5
	40			14.0	29.3	6.4	49.8			16.2	20.7	6.4	43.3
100	10	90	45	15.9	35.3	7.9	59.1	81	45	18.2	24.5	9.5	52.3
	20			16.8	36.6	8.1	61.5			19.3	25.5	9.9	54.8
	30			17.7	37.8	8.3	63.9			20.5	26.6	10.2	57.3
	40			18.7	39.1	8.6	66.3			21.6	27.6	10.6	59.8
125	10	112	56	19.8	44.2	9.9	73.9	92	56	22.8	30.6	11.9	65.3
	20			21.0	45.7	10.1	76.9			24.2	31.9	12.4	68.4
	30			22.2	47.3	10.4	79.9			25.6	33.2	12.8	71.6
	40			23.4	48.9	10.7	82.9			27.0	34.5	13.2	74.7
150	10	131	67	23.8	53.0	14.2	91.0	103	67	27.3	36.7	14.3	78.4
	20			25.2	54.9	14.7	94.7			29.0	38.3	14.8	82.1
	30			26.6	56.7	15.2	98.5			30.7	39.8	15.4	85.9
	40			28.0	58.6	15.7	102.4			32.4	41.4	15.9	89.7
175	10	143	79	27.8	61.8	16.5	106.1	115	79	31.9	42.8	18.7	93.5
	20			29.4	64.0	17.1	110.5			33.9	44.6	19.5	98.0
	30			31.0	66.2	17.7	115.0			35.8	46.5	20.2	102.5
	40			32.7	68.4	18.3	119.4			37.8	48.3	21.0	107.1
200	10	154	90	31.7	70.7	18.9	121.3	126	90	36.4	49.0	21.4	106.8
	20			33.6	73.1	19.6	126.3			38.7	51.0	22.3	112.0
	30			35.5	75.6	20.3	131.4			40.9	53.1	23.1	117.2
	40			37.4	78.2	20.9	136.5			43.2	55.2	24.0	122.4
250	10	176	112	39.7	88.3	23.6	151.6	148	112	45.6	61.2	27.6	134.3
	20			42.0	91.4	24.5	157.9			48.4	63.8	28.8	140.9
	30			44.4	94.6	25.3	164.2			51.2	66.4	30.0	147.5
	40			46.7	97.7	26.2	170.6			54.0	69.0	31.1	154.1
300	10	198	134	47.6	106.0	31.5	185.1	170	134	54.7	73.4	33.1	161.2
	20			50.4	109.7	32.8	192.9			58.0	76.5	34.5	169.1
	30			53.2	113.5	34.1	200.8			61.4	79.7	35.9	177.0
	40			56.0	117.3	35.4	208.7			64.8	82.8	37.4	185.0
350	10	221	157	55.5	123.7	36.8	216.0	193	157	63.8	85.7	43.5	192.9
	20			58.8	128.0	38.3	225.1			67.7	89.3	45.4	202.4
	30			62.1	132.4	39.8	234.3			71.7	92.9	47.4	212.0
	40			65.4	136.8	41.3	243.5			75.6	96.6	49.4	221.5
400	10	243	179	63.5	141.3	42.0	246.8	215	179	72.9	97.9	49.7	220.5
	20			67.2	146.3	43.7	257.2			77.4	102.0	51.9	231.3
	30			71.0	151.3	45.5	267.7			81.9	106.2	54.2	242.3
	40			74.7	156.3	47.2	278.2			86.4	110.4	56.4	253.2

## 120 CHARACTER DATA RECORD

1410/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.6	.5	2.0		6	3	1.0	.7	.4	2.1
	20			.9	.6	.6	2.1				1.0	.7	.5	2.2
	30			.9	.7	.6	2.2				1.1	.7	.5	2.3
	40			1.0	.7	.6	2.3				1.1	.8	.5	2.4
10	10	14	6	1.7	2.6	.9	5.2		9	6	1.9	1.3	1.0	4.3
	20			1.8	2.7	.9	5.4				2.0	1.4	1.1	4.5
	30			1.9	2.7	.9	5.6				2.1	1.4	1.1	4.7
	40			2.0	2.8	1.0	5.8				2.2	1.5	1.1	4.9
20	10	19	11	3.4	5.1	2.1	10.6		14	11	3.9	2.7	2.3	8.9
	20			3.6	5.3	2.1	11.0				4.1	2.8	2.4	9.3
	30			3.8	5.5	2.2	11.5				4.3	2.9	2.5	9.7
	40			4.0	5.7	2.3	11.9				4.5	3.0	2.6	10.1
30	10	25	17	5.1	7.7	3.4	16.2		20	17	5.8	4.0	3.5	13.3
	20			5.4	8.0	3.5	16.8				6.1	4.2	3.6	13.9
	30			5.7	8.2	3.6	17.5				6.4	4.3	3.8	14.6
	40			5.9	8.5	3.7	18.2				6.7	4.5	3.9	15.2
40	10	30	22	6.8	10.3	4.5	21.6		58	22	7.7	11.2	3.6	22.5
	20			7.2	10.6	4.6	22.4				8.1	11.6	3.7	23.4
	30			7.5	11.0	4.8	23.3				8.6	12.0	3.8	24.3
	40			7.9	11.3	5.0	24.2				9.0	12.4	3.8	25.3
50	10	36	28	8.5	12.8	5.8	27.1		64	28	9.6	14.0	4.5	28.1
	20			9.0	13.3	6.0	28.3				10.2	14.5	4.6	29.3
	30			9.4	13.7	6.2	29.4				10.7	15.0	4.7	30.4
	40			9.9	14.2	6.5	30.5				11.2	15.5	4.8	31.6
60	10	66	33	10.2	24.4	5.4	40.0		69	33	11.6	16.8	5.4	33.7
	20			10.8	25.2	5.5	41.4				12.2	17.4	5.5	35.1
	30			11.3	25.9	5.6	42.9				12.8	18.0	5.6	36.5
	40			11.9	26.6	5.8	44.3				13.5	18.6	5.8	37.9
70	10	78	39	12.0	28.5	6.2	46.7		75	39	13.5	19.6	7.6	40.7
	20			12.6	29.4	6.4	48.3				14.2	20.3	7.9	42.4
	30			13.2	30.2	6.6	50.0				15.0	21.0	8.1	44.1
	40			13.8	31.1	6.7	51.7				15.7	21.7	8.4	45.8
80	10	88	44	13.7	32.6	7.1	53.4		80	44	15.4	22.4	8.7	46.5
	20			14.4	33.5	7.3	55.2				16.3	23.2	9.0	48.5
	30			15.1	34.5	7.5	57.1				17.1	24.0	9.3	50.4
	40			15.8	35.5	7.7	59.0				18.0	24.8	9.5	52.4
90	10	98	49	15.4	36.6	8.0	60.0		85	49	17.4	25.2	9.8	52.4
	20			16.2	37.7	8.2	62.2				18.3	26.1	10.1	54.5
	30			17.0	38.8	8.4	64.3				19.3	27.0	10.4	56.7
	40			17.8	40.0	8.7	66.4				20.2	28.0	10.7	58.9
100	10	110	55	17.1	40.7	8.9	66.7		91	55	19.3	28.0	10.9	58.2
	20			18.0	41.9	9.2	69.1				20.3	29.0	11.2	60.6
	30			18.9	43.2	9.4	71.4				21.4	30.0	11.6	63.0
	40			19.8	44.4	9.6	73.8				22.5	31.1	11.9	65.5
120	10	130	66	20.5	48.9	12.9	82.2		102	66	23.1	33.6	13.1	69.8
	20			21.6	50.3	13.3	85.2				24.4	34.8	13.5	72.7
	30			22.6	51.8	13.7	88.2				25.7	36.0	13.9	75.6
	40			23.7	53.3	14.1	91.1				27.0	37.3	14.3	78.6
140	10	141	77	23.9	57.0	15.1	96.0		113	77	27.0	39.2	17.2	83.4
	20			25.2	58.7	15.5	99.4				28.5	40.6	17.8	86.9
	30			26.4	60.4	16.0	102.9				30.0	42.0	18.4	90.4
	40			27.7	62.2	16.5	106.3				31.5	43.5	19.0	93.9
160	10	151	87	27.3	65.1	17.2	109.7		123	87	30.9	44.8	19.6	95.3
	20			28.8	67.1	17.8	113.6				32.6	46.4	20.3	99.3
	30			30.2	69.1	18.3	117.6				34.3	48.0	21.0	103.3
	40			31.6	71.0	18.9	121.5				36.0	49.7	21.7	107.4
180	10	162	98	30.7	73.3	19.4	123.4		134	98	34.7	50.4	22.1	107.2
	20			32.4	75.5	20.0	127.8				36.6	52.2	22.9	111.7
	30			34.0	77.7	20.6	132.2				38.5	54.0	23.6	116.2
	40			35.6	79.9	21.2	136.7				40.5	55.9	24.4	120.8
200	10	173	109	34.1	81.4	21.5	137.1		145	109	38.6	56.0	25.2	119.8
	20			35.9	83.9	22.2	142.0				40.7	58.0	26.2	124.9
	30			37.7	86.3	22.9	146.9				42.8	60.1	27.1	130.0
	40			39.5	88.8	23.6	151.9				45.0	62.1	28.1	135.1

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	.9	.7	.6	2.2		7	4	1.0	.7	.6	2.3
	20			1.0	.7	.6	2.3				1.1	.8	.6	2.4
	30			1.0	.7	.7	2.4				1.1	.8	.6	2.5
	40			1.0	.8	.7	2.5				1.2	.8	.6	2.6
10	10	15	7	1.8	2.8	1.0	5.7		10	7	2.1	1.5	1.2	4.8
	20			1.9	2.9	1.0	5.8				2.2	1.5	1.3	5.0
	30			2.0	3.0	1.0	6.0				2.3	1.6	1.3	5.2
	40			2.1	3.1	1.1	6.2				2.4	1.6	1.4	5.4
20	10	21	13	3.6	5.7	2.3	11.6		16	13	4.1	3.0	2.8	9.8
	20			3.8	5.9	2.3	12.0				4.3	3.1	2.9	10.3
	30			4.0	6.0	2.4	12.4				4.5	3.2	3.0	10.7
	40			4.2	6.2	2.5	12.9				4.7	3.3	3.1	11.1
30	10	27	19	5.5	8.5	3.7	17.7		55	19	6.2	9.3	3.0	18.4
	20			5.7	8.8	3.8	18.3				6.5	9.6	3.0	19.1
	30			6.0	9.1	4.0	19.0				6.8	9.9	3.1	19.8
	40			6.2	9.3	4.1	19.7				7.1	10.2	3.2	20.5
40	10	33	25	7.3	11.4	5.1	23.7		61	25	8.2	12.4	4.0	24.6
	20			7.6	11.7	5.3	24.6				8.6	12.8	4.0	25.5
	30			8.0	12.1	5.5	25.5				9.1	13.2	4.1	26.4
	40			8.3	12.4	5.7	26.4				9.5	13.6	4.2	27.4
50	10	40	32	9.1	14.2	6.4	29.7		68	32	10.3	15.5	4.9	30.7
	20			9.5	14.7	6.6	30.8				10.8	16.0	5.1	31.9
	30			10.0	15.1	6.8	31.9				11.3	16.5	5.2	33.0
	40			10.4	15.6	7.1	33.0				11.9	17.1	5.3	34.2
60	10	76	38	10.9	27.3	5.9	44.1		74	38	12.3	18.6	7.3	38.2
	20			11.4	28.0	6.1	45.5				13.0	19.2	7.5	39.7
	30			11.9	28.7	6.2	46.9				13.6	19.8	7.7	41.1
	40			12.5	29.4	6.3	48.3				14.2	20.5	7.9	42.6
70	10	88	44	12.7	31.8	6.9	51.4		80	44	14.4	21.7	8.5	44.6
	20			13.3	32.6	7.1	53.0				15.1	22.4	8.7	46.3
	30			13.9	33.5	7.2	54.7				15.9	23.2	9.0	48.0
	40			14.6	34.3	7.4	56.3				16.6	23.9	9.2	49.7
80	10	100	50	14.5	36.3	7.9	58.8		86	50	16.4	24.8	9.7	51.0
	20			15.2	37.3	8.1	60.6				17.3	25.6	10.0	52.9
	30			15.9	38.3	8.3	62.5				18.1	26.5	10.2	54.8
	40			16.6	39.2	8.5	64.3				19.0	27.3	10.5	56.8
90	10	114	57	16.4	40.9	8.9	66.1		93	57	18.5	28.0	10.9	57.3
	20			17.1	42.0	9.1	68.2				19.4	28.9	11.2	59.5
	30			17.9	43.0	9.3	70.3				20.4	29.8	11.5	61.7
	40			18.7	44.2	9.5	72.4				21.4	30.7	11.8	63.9
100	10	126	63	18.2	45.4	9.9	73.5		99	63	20.5	31.1	12.1	63.7
	20			19.0	46.6	10.1	75.8				21.6	32.1	12.5	66.1
	30			19.9	47.8	10.3	78.1				22.7	33.1	12.8	68.5
	40			20.8	49.1	10.6	80.4				23.7	34.1	13.1	71.0
120	10	139	75	21.8	54.5	14.3	90.6		111	75	24.6	37.3	16.4	78.3
	20			22.8	55.9	14.7	93.5				25.9	38.5	16.9	81.3
	30			23.9	57.4	15.2	96.4				27.2	39.7	17.4	84.3
	40			24.9	58.9	15.6	99.4				28.5	40.9	18.0	87.4
140	10	152	88	25.4	63.6	16.7	105.7		124	88	28.8	43.5	19.1	91.4
	20			26.7	65.3	17.2	109.1				30.2	44.9	19.7	94.9
	30			27.9	67.0	17.7	112.5				31.7	46.3	20.3	98.4
	40			29.1	68.7	18.2	115.9				33.2	47.7	21.0	101.9
160	10	164	100	29.1	72.7	19.1	120.8		136	100	32.9	49.7	21.9	104.4
	20			30.5	74.6	19.6	124.7				34.6	51.3	22.6	108.4
	30			31.9	76.5	20.2	128.6				36.3	52.9	23.3	112.4
	40			33.3	78.5	20.8	132.5				38.0	54.6	23.9	116.5
180	10	177	113	32.7	81.8	21.5	135.9		149	113	37.0	55.9	25.2	118.1
	20			34.3	83.9	22.1	140.3				38.9	57.7	26.1	122.7
	30			35.8	86.1	22.7	144.7				40.8	59.5	27.0	127.3
	40			37.4	88.3	23.3	149.1				42.7	61.4	27.8	131.9
200	10	189	125	36.3	90.8	23.9	151.1		161	125	41.1	62.1	28.0	131.2
	20			38.1	93.2	24.6	155.9				43.2	64.1	29.0	136.3
	30			39.8	95.7	25.3	160.7				45.3	66.2	29.9	141.4
	40			41.6	98.1	25.9	165.6				47.5	68.2	30.9	146.6

## 160 CHARACTER DATA RECORD

1410/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	1.0	.8	.7	2.4	7	4	1.1	.8	.6	2.6
	20			1.0	.8	.7	2.5			1.1	.9	.7	2.7
	30			1.1	.8	.7	2.6			1.2	.9	.7	2.7
	40			1.1	.8	.8	2.7			1.2	.9	.7	2.8
10	10	16	8	2.0	3.2	1.1	6.3	11	8	2.2	1.7	1.4	5.2
	20			2.0	3.3	1.1	6.4			2.3	1.7	1.4	5.4
	30			2.1	3.4	1.1	6.6			2.4	1.8	1.5	5.6
	40			2.2	3.5	1.2	6.8			2.5	1.8	1.5	5.8
20	10	23	15	3.9	6.4	2.5	12.8	18	15	4.4	3.3	3.1	10.8
	20			4.1	6.6	2.6	13.3			4.6	3.4	3.2	11.2
	30			4.2	6.8	2.7	13.7			4.8	3.5	3.3	11.6
	40			4.4	6.9	2.7	14.1			5.0	3.6	3.4	12.0
30	10	31	23	5.9	9.6	4.1	19.6	59	23	6.5	10.5	3.3	20.3
	20			6.1	9.9	4.2	20.2			6.8	10.8	3.4	21.0
	30			6.3	10.1	4.4	20.9			7.1	11.1	3.4	21.7
	40			6.6	10.4	4.5	21.5			7.4	11.4	3.5	22.3
40	10	38	30	7.8	12.8	5.7	26.3	66	30	8.7	14.0	4.4	27.1
	20			8.1	13.2	5.8	27.1			9.1	14.4	4.5	28.0
	30			8.5	13.5	6.0	28.0			9.5	14.8	4.6	28.9
	40			8.8	13.9	6.2	28.9			9.9	15.2	4.7	29.8
50	10	74	37	9.8	25.7	5.5	41.0	73	37	10.9	17.5	6.8	35.2
	20			10.2	26.3	5.6	42.1			11.4	18.0	7.0	36.4
	30			10.6	26.9	5.7	43.2			11.9	18.5	7.1	37.5
	40			11.0	27.5	5.8	44.4			12.4	19.0	7.3	38.7
60	10	90	45	11.7	30.9	6.6	49.2	81	45	13.1	21.0	8.2	42.2
	20			12.2	31.6	6.7	50.5			13.7	21.6	8.4	43.6
	30			12.7	32.3	6.9	51.9			14.3	22.2	8.6	45.0
	40			13.2	33.0	7.0	53.2			14.9	22.8	8.8	46.5
70	10	104	52	13.7	36.0	7.7	57.4	88	52	15.2	24.5	9.5	49.2
	20			14.2	36.9	7.9	58.9			15.9	25.2	9.8	50.9
	30			14.8	37.7	8.0	60.5			16.6	25.9	10.0	52.5
	40			15.4	38.5	8.2	62.1			17.4	26.6	10.2	54.2
80	10	118	59	15.6	41.2	8.8	65.6	95	59	17.4	28.0	10.9	56.3
	20			16.3	42.1	9.0	67.4			18.2	28.8	11.2	58.2
	30			16.9	43.1	9.2	69.2			19.0	29.6	11.4	60.1
	40			17.6	44.0	9.4	71.0			19.8	30.4	11.7	61.9
90	10	131	67	17.6	46.3	12.0	75.9	103	67	19.6	31.5	12.2	63.3
	20			18.3	47.4	12.4	78.0			20.5	32.4	12.6	65.4
	30			19.0	48.5	12.7	80.2			21.4	33.3	12.9	67.6
	40			19.8	49.5	13.0	82.3			22.3	34.2	13.2	69.7
100	10	138	74	19.5	51.5	13.4	84.4	110	74	21.8	35.0	15.4	72.2
	20			20.3	52.7	13.7	86.7			22.8	36.0	15.9	74.6
	30			21.2	53.8	14.1	89.1			23.8	37.0	16.3	77.1
	40			22.0	55.0	14.4	91.4			24.8	38.0	16.7	79.5
120	10	153	89	23.4	61.8	16.1	101.2	125	89	26.1	42.0	18.5	86.6
	20			24.4	63.2	16.5	104.0			27.3	43.2	19.0	89.6
	30			25.4	64.6	16.9	106.9			28.5	44.4	19.6	92.5
	40			26.4	66.1	17.3	109.7			29.8	45.6	20.1	95.4
140	10	167	103	27.3	72.1	18.7	118.1	139	103	30.5	49.0	21.6	101.1
	20			28.5	73.7	19.2	121.4			31.9	50.4	22.2	104.5
	30			29.6	75.4	19.7	124.7			33.3	51.8	22.8	107.9
	40			30.8	77.1	20.2	128.0			34.7	53.2	23.4	111.4
160	10	182	118	31.2	82.4	21.4	135.0	154	118	34.8	56.0	25.3	116.1
	20			32.5	84.2	22.0	138.7			36.4	57.6	26.0	120.1
	30			33.8	86.2	22.5	142.5			38.1	59.2	26.8	124.0
	40			35.2	88.1	23.1	146.3			39.7	60.8	27.6	128.1
180	10	197	133	35.1	92.7	27.0	154.8	169	133	39.2	63.0	28.4	130.6
	20			36.6	94.8	27.8	159.2			41.0	64.8	29.3	135.1
	30			38.1	96.9	28.6	163.6			42.8	66.6	30.2	139.6
	40			39.6	99.1	29.4	168.0			44.6	68.4	31.0	144.1
200	10	212	148	39.0	103.0	30.0	172.0	184	148	43.5	70.0	36.6	150.1
	20			40.7	105.3	30.9	176.9			45.5	72.0	37.8	155.3
	30			42.3	107.7	31.8	181.8			47.6	74.0	38.9	160.4
	40			44.0	110.1	32.6	186.7			49.6	76.0	40.0	165.6

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.0	1.8	.6	3.4		8	5	1.2	.9	.7	2.8
	20			1.1	1.8	.6	3.5				1.2	.9	.7	2.9
	30			1.1	1.9	.6	3.6				1.3	1.0	.7	3.0
	40			1.2	1.9	.6	3.7				1.3	1.0	.8	3.1
10	10	17	9	2.1	3.5	1.4	7.0		12	9	2.3	1.8	1.5	5.7
	20			2.2	3.6	1.4	7.2				2.4	1.9	1.6	5.9
	30			2.2	3.7	1.5	7.4				2.5	1.9	1.6	6.1
	40			2.3	3.8	1.5	7.6				2.6	2.0	1.7	6.3
20	10	25	17	4.2	7.1	3.0	14.2		20	17	4.6	3.6	3.0	11.3
	20			4.3	7.2	3.1	14.7				4.8	3.7	3.1	11.7
	30			4.5	7.4	3.2	15.1				5.0	3.9	3.2	12.1
	40			4.7	7.6	3.3	15.5				5.2	4.0	3.3	12.5
30	10	33	25	6.3	10.6	4.6	21.5		61	25	6.9	11.6	3.6	22.1
	20			6.5	10.8	4.8	22.1				7.2	11.9	3.7	22.8
	30			6.7	11.1	4.9	22.8				7.5	12.2	3.8	23.5
	40			7.0	11.4	5.1	23.4				7.9	12.5	3.8	24.1
40	10	68	34	8.4	22.8	4.8	36.0		70	34	9.2	15.4	4.8	29.5
	20			8.7	23.3	4.9	36.9				9.7	15.8	4.9	30.4
	30			9.0	23.7	5.0	37.7				10.1	16.2	5.0	31.3
	40			9.3	24.2	5.1	38.6				10.5	16.6	5.1	32.2
50	10	84	42	10.5	28.5	6.0	45.0		78	42	11.6	19.3	7.5	38.4
	20			10.8	29.1	6.1	46.1				12.1	19.8	7.7	39.5
	30			11.2	29.7	6.3	47.2				12.6	20.3	7.8	40.7
	40			11.6	30.3	6.4	48.3				13.1	20.8	8.0	41.9
60	10	100	50	12.5	34.2	7.2	54.0		86	50	13.9	23.2	9.0	46.0
	20			13.0	34.9	7.4	55.3				14.5	23.7	9.2	47.4
	30			13.5	35.6	7.5	56.6				15.1	24.3	9.4	48.8
	40			14.0	36.3	7.6	57.9				15.7	24.9	9.6	50.3
70	10	118	59	14.6	39.9	8.4	63.0		95	59	16.2	27.0	10.5	53.7
	20			15.2	40.7	8.6	64.5				16.9	27.7	10.7	55.3
	30			15.7	41.5	8.8	66.0				17.6	28.4	11.0	57.0
	40			16.3	42.4	8.9	67.6				18.3	29.1	11.2	58.6
80	10	131	67	16.7	45.6	11.8	74.1		103	67	18.5	30.9	12.0	61.4
	20			17.4	46.5	12.1	75.9				19.3	31.7	12.3	63.2
	30			18.0	47.5	12.3	77.8				20.1	32.5	12.5	65.1
	40			18.6	48.4	12.6	79.7				20.9	33.2	12.8	67.0
90	10	139	75	18.8	51.3	13.2	83.4		111	75	20.8	34.7	15.4	70.9
	20			19.5	52.3	13.6	85.4				21.7	35.6	15.8	73.1
	30			20.2	53.4	13.9	87.5				22.6	36.5	16.1	75.3
	40			21.0	54.5	14.2	89.6				23.6	37.4	16.5	77.5
100	10	148	84	20.9	57.0	14.7	92.6		120	84	23.1	38.6	17.1	78.8
	20			21.7	58.2	15.1	94.9				24.1	39.6	17.5	81.2
	30			22.5	59.3	15.4	97.2				25.2	40.6	17.9	83.7
	40			23.3	60.5	15.8	99.6				26.2	41.6	18.4	86.1
120	10	164	100	25.1	68.4	17.7	111.1		136	100	27.7	46.3	20.5	94.6
	20			26.0	69.8	18.1	113.9				29.0	47.5	21.0	97.5
	30			27.0	71.2	18.5	116.7				30.2	48.7	21.5	100.4
	40			27.9	72.6	18.9	119.5				31.4	49.9	22.1	103.3
140	10	181	117	29.3	79.8	20.6	129.7		153	117	32.4	54.0	24.4	110.8
	20			30.4	81.4	21.1	132.9				33.8	55.4	25.1	114.3
	30			31.5	83.1	21.6	136.1				35.2	56.8	25.8	117.8
	40			32.6	84.7	22.1	139.4				36.6	58.2	26.4	121.3
160	10	198	134	33.4	91.2	26.5	151.2		170	134	37.0	61.8	27.9	126.7
	20			34.7	93.1	27.2	155.0				38.6	63.3	28.7	130.6
	30			36.0	94.9	27.9	158.8				40.2	64.9	29.4	134.6
	40			37.3	96.8	28.6	162.7				41.9	66.5	30.2	138.6
180	10	214	150	37.6	102.6	29.8	170.0		186	150	41.6	69.5	36.7	147.8
	20			39.1	104.7	30.6	174.3				43.4	71.2	37.7	152.4
	30			40.5	106.8	31.4	178.7				45.3	73.0	38.7	157.0
	40			41.9	108.9	32.2	183.0				47.1	74.8	39.8	161.7
200	10	231	167	41.8	114.0	33.1	188.9		203	167	46.2	77.2	40.8	164.2
	20			43.4	116.3	34.0	193.7				48.3	79.2	41.9	169.3
	30			45.0	118.7	34.9	198.5				50.3	81.1	43.0	174.5
	40			46.6	121.0	35.7	203.4				52.3	83.1	44.2	179.6

## 200 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.1	1.9	.7	3.6	8	5	1.1	1.0	.7	2.8
	20			1.1	1.9	.7	3.7			1.1	1.0	.8	2.9
	30			1.2	2.0	.7	3.8			1.2	1.0	.8	3.0
	40			1.2	2.0	.7	3.9			1.2	1.0	.8	3.1
10	10	17	9	2.2	3.8	1.5	7.4	12	9	2.2	1.9	1.6	5.8
	20			2.3	3.8	1.5	7.6			2.3	2.0	1.7	5.9
	30			2.4	3.9	1.6	7.8			2.4	2.0	1.7	6.1
	40			2.4	4.0	1.6	8.0			2.5	2.1	1.8	6.3
20	10	26	18	4.4	7.5	3.2	15.1	21	18	4.4	3.9	3.2	11.5
	20			4.6	7.7	3.3	15.5			4.6	4.0	3.3	11.9
	30			4.7	7.9	3.4	16.0			4.8	4.1	3.4	12.3
	40			4.9	8.0	3.5	16.4			5.0	4.2	3.5	12.7
30	10	35	27	6.6	11.3	4.9	22.8	63	27	6.6	12.3	3.9	22.8
	20			6.9	11.5	5.1	23.5			6.9	12.6	3.9	23.4
	30			7.1	11.8	5.2	24.1			7.2	12.9	4.0	24.1
	40			7.3	12.1	5.4	24.7			7.4	13.2	4.1	24.7
40	10	72	36	8.8	24.3	5.2	38.4	72	36	8.8	16.4	5.2	30.5
	20			9.1	24.8	5.2	39.1			9.2	16.8	5.2	31.2
	30			9.4	25.2	5.3	40.0			9.6	17.2	5.3	32.1
	40			9.8	25.7	5.4	40.9			9.9	17.6	5.4	33.0
50	10	90	45	11.0	30.4	6.6	47.9	81	45	11.0	20.5	8.0	39.5
	20			11.4	30.9	6.6	48.9			11.5	21.0	8.2	40.7
	30			11.8	31.5	6.7	50.0			11.9	21.5	8.3	41.8
	40			12.2	32.1	6.8	51.1			12.4	22.0	8.5	42.9
60	10	108	54	13.2	36.4	7.9	57.5	90	54	13.2	24.6	9.6	47.4
	20			13.7	37.1	7.9	58.7			13.8	25.2	9.8	48.8
	30			14.2	37.8	8.0	60.0			14.3	25.8	10.0	50.2
	40			14.6	38.5	8.2	61.3			14.9	26.4	10.2	51.5
70	10	126	63	15.4	42.5	9.2	67.1	99	63	15.4	28.7	11.2	55.3
	20			16.0	43.3	9.2	68.5			16.1	29.4	11.4	56.9
	30			16.5	44.1	9.3	70.0			16.7	30.1	11.7	58.5
	40			17.1	45.0	9.5	71.5			17.4	30.8	11.9	60.1
80	10	136	72	17.6	48.6	12.6	78.8	108	72	17.6	32.8	12.8	63.2
	20			18.3	49.5	12.8	80.6			18.4	33.6	13.1	65.1
	30			18.9	50.4	13.1	82.5			19.1	34.4	13.4	66.9
	40			19.5	51.4	13.4	84.3			19.9	35.2	13.6	68.7
90	10	145	81	19.9	54.7	14.1	88.6	117	81	19.8	36.9	16.4	73.1
	20			20.6	55.7	14.5	90.7			20.7	37.8	16.8	75.3
	30			21.3	56.7	14.8	92.8			21.5	38.7	17.2	77.4
	40			22.0	57.8	15.1	94.8			22.3	39.6	17.6	79.5
100	10	154	90	22.1	60.7	15.7	98.5	126	90	22.0	41.0	18.2	81.3
	20			22.8	61.9	16.1	100.8			23.0	42.0	18.7	83.6
	30			23.6	63.0	16.4	103.1			23.9	43.0	19.1	86.0
	40			24.4	64.2	16.8	105.4			24.8	44.0	19.5	88.4
120	10	172	108	26.5	72.9	18.9	118.2	144	108	26.4	49.3	21.9	97.5
	20			27.4	74.3	19.3	120.9			27.5	50.4	22.4	100.3
	30			28.3	75.7	19.7	123.7			28.7	51.6	22.9	103.2
	40			29.3	77.1	20.1	126.5			29.8	52.8	23.4	106.0
140	10	189	125	30.9	85.0	22.0	137.9	161	125	30.8	57.5	26.0	114.3
	20			32.0	86.6	22.5	141.1			32.1	58.8	26.7	117.7
	30			33.1	88.3	23.0	144.3			33.4	60.2	27.4	121.0
	40			34.2	89.9	23.5	147.5			34.8	61.6	28.1	124.4
160	10	207	143	35.3	97.2	28.3	160.7	179	143	35.2	65.7	29.8	130.7
	20			36.5	99.0	29.0	164.5			36.7	67.2	30.5	134.5
	30			37.8	100.9	29.7	168.3			38.2	68.8	31.3	138.3
	40			39.0	102.8	30.4	172.2			39.7	70.4	32.1	142.2
180	10	225	161	39.7	109.3	31.8	180.8	197	161	39.6	73.9	39.2	152.7
	20			41.1	111.4	32.6	185.1			41.3	75.6	40.2	157.1
	30			42.5	113.5	33.4	189.4			43.0	77.4	41.2	161.6
	40			43.9	115.6	34.2	193.7			44.7	79.2	42.2	166.1
200	10	243	179	44.1	121.5	35.3	200.9	215	179	44.0	82.1	43.5	169.7
	20			45.7	123.8	36.2	205.6			45.9	84.0	44.7	174.6
	30			47.2	126.1	37.1	210.4			47.8	86.0	45.8	179.6
	40			48.8	128.5	38.0	215.2			49.7	88.0	46.9	184.6

## 220 CHARACTER DATA RECORD

1410/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.2	2.1	.7	4.0		9	6	1.2	1.1	.8	3.1
	20			1.2	2.1	.7	4.1				1.2	1.1	.8	3.2
	30			1.3	2.2	.7	4.2				1.3	1.1	.9	3.3
	40			1.3	2.2	.7	4.3				1.3	1.2	.9	3.4
10	10	19	11	2.4	4.2	1.6	8.2		14	11	2.4	2.2	1.8	6.4
	20			2.5	4.3	1.7	8.4				2.4	2.2	1.9	6.6
	30			2.5	4.4	1.7	8.6				2.5	2.3	1.9	6.7
	40			2.6	4.5	1.7	8.8				2.6	2.3	2.0	6.9
15	10	24	16	3.6	6.3	2.5	12.4		19	16	3.5	3.2	2.8	9.5
	20			3.7	6.4	2.5	12.7				3.7	3.3	2.8	9.8
	30			3.8	6.6	2.6	13.0				3.8	3.4	2.9	10.1
	40			3.9	6.7	2.6	13.3				3.9	3.5	3.0	10.4
20	10	29	21	4.8	8.4	3.5	16.8		57	21	4.7	9.2	3.0	16.9
	20			4.9	8.6	3.6	17.2				4.9	9.4	3.0	17.3
	30			5.1	8.8	3.7	17.6				5.1	9.6	3.0	17.7
	40			5.2	8.9	3.8	18.0				5.2	9.8	3.0	18.0
25	10	35	27	6.0	10.5	4.6	21.1		63	27	5.9	11.6	3.7	21.1
	20			6.2	10.7	4.7	21.6				6.1	11.8	3.7	21.6
	30			6.4	11.0	4.8	22.1				6.3	12.0	3.7	22.1
	40			6.6	11.2	4.9	22.7				6.6	12.3	3.7	22.6
30	10	40	32	7.2	12.6	5.5	25.3		68	32	7.1	13.9	4.5	25.4
	20			7.4	12.9	5.6	25.9				7.3	14.1	4.5	25.9
	30			7.6	13.2	5.7	26.5				7.6	14.4	4.5	26.5
	40			7.9	13.4	5.9	27.2				7.9	14.7	4.5	27.1
35	10	74	37	8.4	24.0	5.2	37.6		73	37	8.2	16.2	6.3	30.7
	20			8.6	24.4	5.2	38.3				8.5	16.5	6.4	31.4
	30			8.9	24.8	5.2	38.9				8.9	16.8	6.5	32.2
	40			9.2	25.2	5.2	39.6				9.2	17.2	6.6	33.0
40	10	84	42	9.6	27.5	5.9	43.0		78	42	9.4	18.5	7.2	35.0
	20			9.9	27.9	5.9	43.7				9.8	18.9	7.3	35.9
	30			10.2	28.4	5.9	44.5				10.1	19.3	7.4	36.8
	40			10.5	28.8	6.0	45.3				10.5	19.6	7.6	37.7
45	10	94	47	10.8	30.9	6.7	48.3		83	47	10.6	20.8	8.0	39.4
	20			11.1	31.4	6.7	49.2				11.0	21.2	8.2	40.4
	30			11.5	31.9	6.7	50.1				11.4	21.7	8.4	41.4
	40			11.8	32.4	6.7	51.0				11.8	22.1	8.5	42.4
50	10	106	53	12.0	34.3	7.4	53.7		89	53	11.8	23.1	8.9	43.8
	20			12.3	34.9	7.4	54.7				12.2	23.6	9.1	44.9
	30			12.7	35.5	7.4	55.6				12.7	24.1	9.3	46.0
	40			13.1	36.1	7.5	56.6				13.1	24.6	9.5	47.1
55	10	116	58	13.2	37.8	8.2	59.1		94	58	12.9	25.4	9.8	48.2
	20			13.6	38.4	8.2	60.1				13.4	25.9	10.0	49.4
	30			14.0	39.0	8.2	61.2				13.9	26.5	10.2	50.6
	40			14.4	39.7	8.2	62.3				14.4	27.0	10.4	51.8
60	10	126	63	14.4	41.2	8.9	64.5		99	63	14.1	27.7	10.7	52.6
	20			14.8	41.9	8.9	65.6				14.6	28.3	10.9	53.9
	30			15.3	42.6	8.9	66.8				15.2	28.9	11.1	55.2
	40			15.7	43.3	8.9	67.9				15.7	29.5	11.4	56.5
70	10	137	73	16.7	48.1	12.3	77.1		109	73	16.5	32.3	14.4	63.2
	20			17.3	48.9	12.5	78.7				17.1	33.0	14.7	64.8
	30			17.8	49.7	12.8	80.2				17.7	33.7	15.0	66.4
	40			18.4	50.5	13.0	81.8				18.3	34.4	15.3	68.0
80	10	148	84	19.1	54.9	14.0	88.1		120	84	18.8	37.0	16.4	72.2
	20			19.8	55.8	14.3	89.9				19.5	37.7	16.8	74.0
	30			20.4	56.8	14.6	91.7				20.2	38.5	17.1	75.9
	40			21.0	57.7	14.9	93.5				21.0	39.3	17.5	77.7
90	10	158	94	21.5	61.8	15.8	99.1		130	94	21.2	41.6	18.5	81.2
	20			22.2	62.8	16.1	101.1				22.0	42.4	18.9	83.3
	30			22.9	63.8	16.4	103.2				22.8	43.3	19.3	85.4
	40			23.6	64.9	16.7	105.2				23.6	44.2	19.7	87.4
100	10	169	105	23.9	68.7	17.5	110.1		141	105	23.5	46.2	20.5	90.3
	20			24.7	69.8	17.9	112.4				24.4	47.2	21.0	92.5
	30			25.5	70.9	18.2	114.6				25.3	48.1	21.4	94.8
	40			26.2	72.1	18.6	116.9				26.2	49.1	21.9	97.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.3	2.3	.8	4.3	9	6	1.3	1.2	.9	3.3
	20			1.3	2.3	.8	4.4			1.3	1.2	.9	3.4
	30			1.3	2.4	.8	4.5			1.3	1.2	.9	3.5
	40			1.4	2.4	.8	4.6			1.4	1.2	.9	3.6
10	10	20	12	2.5	4.5	1.8	8.8	15	12	2.5	2.3	2.0	6.8
	20			2.6	4.6	1.8	9.0			2.6	2.4	2.0	7.0
	30			2.7	4.7	1.8	9.2			2.7	2.4	2.1	7.2
	40			2.7	4.8	1.9	9.4			2.8	2.5	2.1	7.4
15	10	26	18	3.8	6.8	2.9	13.4	21	18	3.8	3.5	3.0	10.2
	20			3.9	6.9	2.9	13.7			3.9	3.6	3.0	10.5
	30			4.0	7.1	3.0	14.0			4.0	3.6	3.1	10.8
	40			4.1	7.2	3.1	14.3			4.1	3.7	3.2	11.0
20	10	31	23	5.0	9.1	3.8	17.9	59	23	5.0	9.9	3.2	18.2
	20			5.2	9.2	3.9	18.3			5.1	10.1	3.2	18.5
	30			5.3	9.4	4.0	18.7			5.3	10.3	3.2	18.9
	40			5.5	9.6	4.1	19.1			5.5	10.5	3.2	19.3
25	10	37	29	6.3	11.3	4.9	22.5	65	29	6.3	12.4	4.0	22.8
	20			6.5	11.5	5.0	23.0			6.4	12.7	4.0	23.2
	30			6.7	11.8	5.1	23.5			6.7	12.9	4.1	23.6
	40			6.8	12.0	5.2	24.1			6.9	13.2	4.1	24.1
30	10	70	35	7.6	22.2	4.9	34.6	71	35	7.5	14.9	4.9	27.3
	20			7.8	22.6	4.9	35.2			7.7	15.2	4.9	27.8
	30			8.0	22.9	4.9	35.8			8.0	15.5	4.9	28.3
	40			8.2	23.2	4.9	36.3			8.3	15.8	4.9	28.9
35	10	80	40	8.8	25.9	5.7	40.4	76	40	8.8	17.4	6.7	32.9
	20			9.1	26.3	5.7	41.1			9.0	17.7	6.9	33.6
	30			9.3	26.7	5.7	41.7			9.3	18.1	7.0	34.4
	40			9.6	27.1	5.7	42.4			9.6	18.4	7.1	35.2
40	10	92	46	10.1	29.6	6.5	46.2	82	46	10.0	19.9	7.7	37.6
	20			10.4	30.1	6.5	46.9			10.3	20.3	7.8	38.4
	30			10.7	30.5	6.5	47.7			10.7	20.7	8.0	39.3
	40			11.0	31.0	6.5	48.4			11.0	21.0	8.1	40.2
45	10	104	52	11.3	33.3	7.3	51.9	88	52	11.3	22.4	8.7	42.3
	20			11.7	33.8	7.3	52.8			11.6	22.8	8.8	43.2
	30			12.0	34.3	7.3	53.6			12.0	23.2	9.0	44.2
	40			12.3	34.9	7.3	54.5			12.4	23.7	9.1	45.2
50	10	114	57	12.6	37.0	8.1	57.7	93	57	12.5	24.9	9.6	47.0
	20			13.0	37.6	8.1	58.7			12.9	25.3	9.8	48.0
	30			13.3	38.2	8.1	59.6			13.3	25.8	10.0	49.1
	40			13.7	38.7	8.1	60.6			13.8	26.3	10.1	50.2
55	10	126	63	13.8	40.7	8.9	63.5	99	63	13.8	27.4	10.6	51.7
	20			14.3	41.4	8.9	64.5			14.2	27.9	10.8	52.8
	30			14.7	42.0	8.9	65.6			14.7	28.4	11.0	54.0
	40			15.1	42.6	8.9	66.6			15.2	28.9	11.2	55.2
60	10	133	69	15.1	44.4	11.3	70.9	105	69	15.1	29.8	11.5	56.4
	20			15.5	45.1	11.5	72.2			15.4	30.4	11.8	57.6
	30			16.0	45.8	11.7	73.5			16.0	31.0	12.0	58.9
	40			16.4	46.5	11.9	74.9			16.5	31.6	12.2	60.3
70	10	144	80	17.6	51.9	13.2	82.7	116	80	17.6	34.8	15.5	67.9
	20			18.1	52.6	13.4	84.2			18.0	35.5	15.8	69.3
	30			18.7	53.4	13.7	85.8			18.7	36.1	16.1	70.9
	40			19.2	54.2	13.9	87.3			19.3	36.8	16.4	72.5
80	10	155	91	20.1	59.3	15.1	94.5	127	91	20.1	39.8	17.7	77.6
	20			20.7	60.2	15.3	96.2			20.6	40.5	18.1	79.2
	30			21.3	61.1	15.6	98.0			21.3	41.3	18.4	81.1
	40			21.9	62.0	15.9	99.8			22.0	42.1	18.8	82.9
90	10	167	103	22.7	66.7	17.0	106.3	139	103	22.6	44.8	19.9	87.3
	20			23.3	67.7	17.3	108.3			23.2	45.6	20.3	89.1
	30			24.0	68.7	17.6	110.3			24.0	46.5	20.7	91.2
	40			24.7	69.7	17.9	112.3			24.8	47.3	21.1	93.3
100	10	178	114	25.2	74.1	18.8	118.1	150	114	25.1	49.7	22.6	97.4
	20			25.9	75.2	19.2	120.3			25.7	50.7	23.1	99.5
	30			26.7	76.3	19.5	122.5			26.6	51.6	23.5	101.8
	40			27.4	77.5	19.9	124.8			27.5	52.6	24.0	104.2



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.3	2.4	.9	4.7	10	7	1.3	1.3	1.0	3.6
	20			1.4	2.5	.9	4.7			1.4	1.3	1.1	3.7
	30			1.4	2.5	.9	4.8			1.4	1.3	1.1	3.8
	40			1.4	2.6	.9	4.9			1.4	1.3	1.1	3.9
10	10	21	13	2.7	4.9	1.9	9.5	16	13	2.7	2.5	2.3	7.5
	20			2.7	5.0	1.9	9.7			2.7	2.6	2.4	7.7
	30			2.8	5.1	2.0	9.9			2.8	2.6	2.4	7.8
	40			2.9	5.2	2.0	92.1			2.9	2.7	2.5	8.0
15	10	27	19	4.0	7.3	3.1	14.4	55	19	4.0	8.1	2.6	14.7
	20			4.1	7.5	3.1	14.7			4.1	8.2	2.7	15.0
	30			4.2	7.6	3.2	15.0			4.2	8.4	2.7	15.2
	40			4.3	7.7	3.3	15.3			4.3	8.5	2.7	15.5
20	10	33	25	5.3	9.8	4.2	19.3	61	25	5.3	10.8	3.5	19.7
	20			5.5	10.0	4.3	19.8			5.4	11.0	3.5	19.9
	30			5.6	10.1	4.4	20.2			5.6	11.1	3.5	20.3
	40			5.8	10.3	4.5	20.6			5.7	11.3	3.5	20.6
25	10	40	32	6.7	12.2	5.2	24.2	68	32	6.7	13.5	4.4	24.6
	20			6.9	12.5	5.4	24.7			6.8	13.7	4.4	24.9
	30			7.1	12.7	5.5	25.2			7.0	13.9	4.4	25.3
	40			7.2	12.9	5.6	25.7			7.2	14.2	4.4	25.8
30	10	76	38	8.0	24.1	5.3	37.4	74	38	8.0	16.2	6.2	30.4
	20			8.2	24.5	5.3	38.0			8.2	16.4	6.3	30.9
	30			8.5	24.8	5.3	38.6			8.4	16.7	6.4	31.5
	40			8.7	25.1	5.3	39.1			8.6	17.0	6.6	32.2
35	10	88	44	9.4	28.1	6.2	43.7	80	44	9.4	18.8	7.3	35.5
	20			9.6	28.5	6.2	44.3			9.5	19.2	7.4	36.1
	30			9.9	28.9	6.2	45.0			9.7	19.5	7.5	36.8
	40			10.1	29.3	6.2	45.7			10.1	19.8	7.6	37.5
40	10	100	50	10.7	32.2	7.1	49.9	86	50	10.7	21.5	8.3	40.6
	20			11.0	32.6	7.1	50.7			10.9	21.9	8.5	41.3
	30			11.3	33.1	7.1	51.4			11.1	22.3	8.6	42.0
	40			11.6	33.5	7.1	52.2			11.5	22.7	8.7	42.9
45	10	114	57	12.0	36.2	7.9	56.2	93	57	12.0	24.2	9.4	45.6
	20			12.4	36.7	8.0	57.0			12.3	24.7	9.5	46.4
	30			12.7	37.2	8.0	57.8			12.5	25.1	9.7	47.3
	40			13.0	37.7	8.0	58.7			12.9	25.5	9.8	48.3
50	10	126	63	13.4	40.2	8.8	62.4	99	63	13.4	26.9	10.4	50.7
	20			13.7	40.8	8.8	63.3			13.6	27.4	10.6	51.6
	30			14.1	41.3	8.8	64.3			13.9	27.9	10.7	52.5
	40			14.5	41.9	8.9	65.2			14.4	28.3	10.9	53.6
55	10	133	69	14.7	44.2	11.2	70.1	105	69	14.7	29.6	11.4	55.8
	20			15.1	44.8	11.4	71.3			15.0	30.1	11.6	56.7
	30			15.5	45.4	11.6	72.5			15.3	30.7	11.8	57.8
	40			15.9	46.1	11.8	73.8			15.8	31.2	12.0	59.0
60	10	139	75	16.0	48.2	12.2	76.5	111	75	16.0	32.3	14.4	62.8
	20			16.5	48.9	12.4	77.8			16.3	32.9	14.7	63.9
	30			16.9	49.6	12.6	79.1			16.7	33.4	15.0	65.1
	40			17.4	50.3	12.8	80.5			17.2	34.0	15.2	66.5
70	10	152	88	18.7	56.3	14.2	89.2	124	88	18.7	37.7	16.8	73.3
	20			19.2	57.1	14.5	90.8			19.1	38.4	17.1	74.6
	30			19.8	57.8	14.7	92.3			19.5	39.0	17.4	76.0
	40			20.3	58.6	15.0	93.9			20.1	39.7	17.8	77.5
80	10	164	100	21.4	64.3	16.3	102.0	136	100	21.4	43.1	19.2	83.7
	20			22.0	65.2	16.5	103.7			21.8	43.8	19.6	85.2
	30			22.6	66.1	16.8	105.5			22.3	44.6	19.9	86.8
	40			23.2	67.0	17.1	107.3			23.0	45.4	20.3	88.6
90	10	177	113	24.1	72.4	18.3	114.7	149	113	24.1	48.5	22.0	94.6
	20			24.7	73.4	18.6	116.7			24.5	49.3	22.5	96.3
	30			25.4	74.4	18.9	118.7			25.1	50.2	22.9	98.1
	40			26.1	75.4	19.2	120.7			25.8	51.0	23.3	100.2
100	10	189	125	26.7	80.4	20.3	127.5	161	125	26.7	53.9	24.5	105.1
	20			27.5	81.5	20.7	129.7			27.2	54.8	25.0	107.0
	30			28.2	82.6	21.0	131.9			27.8	55.7	25.5	109.0
	40			29.0	83.8	21.4	134.1			28.7	56.7	25.9	111.4

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.4	2.5	.9	4.8		10	7	1.4	1.3	1.1	3.7
	20			1.4	2.5	.9	4.9				1.4	1.3	1.1	3.8
	30			1.4	2.6	.9	4.9				1.4	1.3	1.1	3.9
	40			1.5	2.6	.9	5.0				1.5	1.3	1.1	3.9
10	10	21	13	2.8	5.0	1.9	9.7		16	13	2.8	2.5	2.4	7.7
	20			2.8	5.1	2.0	9.8				2.8	2.6	2.4	7.8
	30			2.9	5.1	2.0	10.0				2.9	2.6	2.5	8.0
	40			3.0	5.2	2.1	10.2				2.9	2.7	2.5	8.2
15	10	27	19	4.1	7.4	3.1	14.7		55	19	4.2	8.2	2.8	15.1
	20			4.2	7.6	3.2	15.0				4.2	8.3	2.8	15.3
	30			4.3	7.7	3.3	15.3				4.3	8.5	2.8	15.5
	40			4.4	7.8	3.3	15.6				4.4	8.6	2.8	15.8
20	10	33	25	5.5	9.9	4.3	19.7		61	25	5.6	10.9	3.7	20.1
	20			5.6	10.1	4.4	20.1				5.7	11.1	3.7	20.4
	30			5.8	10.3	4.5	20.5				5.8	11.3	3.7	20.7
	40			5.9	10.5	4.6	21.0				5.9	11.5	3.7	21.0
25	10	40	32	6.9	12.4	5.4	24.7		68	32	7.0	13.6	4.6	25.2
	20			7.0	12.6	5.5	25.2				7.1	13.9	4.6	25.5
	30			7.2	12.9	5.6	25.7				7.2	14.1	4.6	25.9
	40			7.4	13.1	5.7	26.2				7.3	14.3	4.6	26.3
30	10	76	38	8.3	24.4	5.5	38.2		74	38	8.3	16.3	6.4	31.0
	20			8.4	24.7	5.5	38.7				8.5	16.6	6.5	31.6
	30			8.7	25.1	5.5	39.2				8.6	16.9	6.6	32.1
	40			8.9	25.4	5.5	39.8				8.8	17.2	6.7	32.7
35	10	88	44	9.6	28.4	6.4	44.5		80	44	9.7	19.1	7.4	36.2
	20			9.9	28.8	6.4	45.1				9.9	19.4	7.5	36.8
	30			10.1	29.2	6.4	45.8				10.1	19.7	7.7	37.5
	40			10.4	29.6	6.4	46.4				10.3	20.1	7.8	38.2
40	10	100	50	11.0	32.5	7.3	50.9		86	50	11.1	21.8	8.5	41.4
	20			11.3	33.0	7.3	51.6				11.3	22.2	8.6	42.1
	30			11.6	33.4	7.4	52.3				11.5	22.5	8.8	42.8
	40			11.9	33.9	7.4	53.1				11.8	22.9	8.9	43.6
45	10	114	57	12.4	36.6	8.3	57.2		93	57	12.5	24.5	9.5	46.6
	20			12.7	37.1	8.3	58.0				12.7	24.9	9.7	47.4
	30			13.0	37.6	8.3	58.9				12.9	25.4	9.9	48.2
	40			13.3	38.1	8.3	59.7				13.2	25.8	10.0	49.1
50	10	126	63	13.8	40.6	9.2	63.6		99	63	13.9	27.2	10.6	51.7
	20			14.1	41.2	9.2	64.5				14.1	27.7	10.8	52.6
	30			14.4	41.8	9.2	65.4				14.4	28.2	11.0	53.5
	40			14.8	42.3	9.2	66.4				14.7	28.7	11.1	54.5
55	10	133	69	15.2	44.7	11.4	71.3		105	69	15.3	30.0	11.7	56.9
	20			15.5	45.3	11.6	72.4				15.6	30.5	11.9	57.9
	30			15.9	45.9	11.8	73.6				15.8	31.0	12.1	58.9
	40			16.3	46.6	12.0	74.9				16.2	31.5	12.3	60.0
60	10	139	75	16.5	48.8	12.5	77.8		111	75	16.7	32.7	14.6	64.0
	20			16.9	49.4	12.7	79.0				17.0	33.2	14.9	65.1
	30			17.3	50.1	12.9	80.3				17.3	33.8	15.2	66.2
	40			17.8	50.8	13.1	81.7				17.6	34.4	15.4	67.5
70	10	152	88	19.3	56.9	14.5	90.7		124	88	19.5	38.1	17.1	74.7
	20			19.7	57.7	14.8	92.2				19.8	38.8	17.4	76.0
	30			20.2	58.5	15.0	93.7				20.1	39.5	17.7	77.3
	40			20.7	59.3	15.3	95.3				20.6	40.1	18.0	78.7
80	10	164	100	22.0	65.0	16.6	103.7		136	100	22.2	43.6	19.5	85.3
	20			22.5	65.9	16.9	105.3				22.6	44.3	19.9	86.8
	30			23.1	66.8	17.2	107.1				23.0	45.1	20.2	88.3
	40			23.7	67.7	17.5	108.9				23.5	45.9	20.6	90.0
90	10	177	113	24.8	73.2	18.7	116.6		149	113	25.0	49.0	22.3	96.4
	20			25.3	74.2	19.0	118.5				25.5	49.9	22.8	98.1
	30			26.0	75.2	19.3	120.5				25.9	50.7	23.2	99.8
	40			26.7	76.2	19.7	122.5				26.5	51.6	23.7	101.7
100	10	189	125	27.5	81.3	20.8	129.6		161	125	27.8	54.5	24.8	107.1
	20			28.2	82.4	21.1	131.7				28.3	55.4	25.3	109.0
	30			28.9	83.5	21.5	133.9				28.8	56.4	25.8	110.9
	40			29.6	84.7	21.8	136.2				29.4	57.3	26.3	113.0

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	1.5	2.7	1.0	5.2	10	7	1.5	1.4	1.2	4.1
	40			1.6	2.8	1.0	5.4			1.6	1.5	1.2	4.2
	60			1.6	2.9	1.0	5.6			1.6	1.5	1.3	4.4
	80			1.7	3.0	1.0	5.7			1.7	1.6	1.3	4.6
10	20	22	14	3.0	5.5	2.1	10.6	17	14	3.0	2.8	2.6	8.4
	40			3.1	5.7	2.2	11.0			3.1	2.9	2.7	8.7
	60			3.3	5.8	2.3	11.4			3.2	3.0	2.8	9.1
	80			3.4	6.0	2.3	11.8			3.4	3.1	3.0	9.5
15	20	29	21	4.5	8.2	3.4	16.2	57	21	4.5	9.0	3.0	16.6
	40			4.7	8.5	3.6	16.7			4.7	9.3	3.0	17.0
	60			4.9	8.8	3.7	17.4			4.9	9.6	3.0	17.5
	80			5.1	9.0	3.8	18.0			5.1	9.9	3.0	18.1
20	20	36	28	6.0	11.0	4.7	21.7	64	28	6.0	12.1	4.0	22.1
	40			6.2	11.3	4.9	22.5			6.2	12.4	4.0	22.7
	60			6.5	11.7	5.1	23.3			6.5	12.8	4.0	23.3
	80			6.8	12.0	5.3	24.1			6.8	13.2	4.0	24.1
25	20	70	35	7.5	22.5	5.0	34.9	71	35	7.5	15.1	5.0	27.6
	40			7.8	23.0	5.0	35.8			7.8	15.6	5.0	28.3
	60			8.1	23.6	5.0	36.8			8.1	16.0	5.0	29.2
	80			8.5	24.2	5.0	37.7			8.5	16.5	5.0	30.1
30	20	84	42	8.9	27.0	6.0	41.9	78	42	9.0	18.1	7.0	34.1
	40			9.3	27.6	6.0	43.0			9.3	18.7	7.2	35.2
	60			9.8	28.3	6.0	44.1			9.7	19.2	7.4	36.4
	80			10.2	29.0	6.0	45.3			10.2	19.8	7.6	37.7
35	20	98	49	10.4	31.5	7.0	48.9	85	49	10.5	21.1	8.2	39.8
	40			10.9	32.3	7.0	50.2			10.9	21.8	8.4	41.0
	60			11.4	33.1	7.0	51.5			11.4	22.5	8.7	42.5
	80			11.9	33.9	7.0	52.8			11.9	23.1	8.9	44.0
40	20	112	56	11.9	36.0	8.0	55.9	92	56	12.0	24.1	9.3	45.5
	40			12.4	36.9	8.0	57.3			12.4	24.9	9.6	46.9
	60			13.0	37.8	8.0	58.8			13.0	25.7	9.9	48.5
	80			13.6	38.7	8.0	60.4			13.6	26.4	10.2	50.3
45	20	126	63	13.4	40.5	9.0	62.9	99	63	13.6	27.1	10.5	51.2
	40			14.0	41.5	9.0	64.5			14.0	28.0	10.8	52.8
	60			14.6	42.5	9.0	66.2			14.6	28.9	11.1	54.6
	80			15.3	43.6	9.1	67.9			15.3	29.8	11.4	56.5
50	20	134	70	14.9	45.0	11.4	71.3	106	70	15.1	30.2	11.7	56.9
	40			15.6	46.1	11.8	73.4			15.5	31.1	12.0	58.6
	60			16.3	47.2	12.1	75.6			16.2	32.1	12.4	60.6
	80			17.0	48.4	12.5	77.9			17.1	33.1	12.7	62.8
55	20	141	77	16.4	49.5	12.5	78.4	113	77	16.6	33.2	14.8	64.5
	40			17.1	50.7	12.9	80.7			17.1	34.2	15.3	66.5
	60			17.9	52.0	13.3	83.2			17.8	35.3	15.8	68.9
	80			18.7	53.2	13.7	85.6			18.8	36.4	16.3	71.4
60	20	148	84	17.9	54.0	13.7	85.5	120	84	18.1	36.2	16.1	70.4
	40			18.7	55.3	14.1	88.1			18.6	37.3	16.7	72.6
	60			19.5	56.7	14.5	90.7			19.5	38.5	17.2	75.1
	80			20.4	58.1	15.0	93.4			20.5	39.7	17.7	77.9
70	20	162	98	20.9	62.9	16.0	99.8	134	98	21.1	42.2	18.8	82.1
	40			21.8	64.5	16.5	102.8			21.7	43.5	19.4	84.7
	60			22.8	66.1	17.0	105.9			22.7	44.9	20.1	87.7
	80			23.8	67.8	17.5	109.0			23.9	46.3	20.7	90.8
80	20	176	112	23.9	71.9	18.2	114.0	148	112	24.1	48.2	21.9	94.3
	40			24.9	73.7	18.8	117.4			24.8	49.8	22.7	97.3
	60			26.0	75.6	19.4	121.0			25.9	51.3	23.5	100.7
	80			27.2	77.4	19.9	124.6			27.3	52.9	24.3	104.4
90	20	189	125	26.8	80.9	20.5	128.3	161	125	27.1	54.3	24.7	106.0
	40			28.0	82.9	21.2	132.1			27.9	56.0	25.5	109.4
	60			29.3	85.0	21.8	136.1			29.2	57.7	26.4	113.3
	80			30.6	87.1	22.4	140.1			30.7	59.5	27.3	117.5
100	20	203	139	29.8	89.9	25.9	145.7	175	139	30.1	60.3	27.4	117.8
	40			31.1	92.2	26.8	150.1			31.0	62.2	28.4	121.6
	60			32.5	94.5	27.7	154.7			32.4	64.1	29.3	125.9
	80			34.0	96.8	28.6	159.4			34.1	66.1	30.3	130.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOO A	MOO B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOO B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	1.9	3.4	1.4	6.7		12	9	1.9	1.8	1.5	5.1
	40			1.9	3.5	1.4	6.8				2.0	1.8	1.5	5.3
	60			2.0	3.6	1.4	7.0				2.0	1.9	1.6	5.4
	80			2.0	3.7	1.4	7.1				2.0	1.9	1.6	5.6
10	20	26	18	3.8	6.9	2.9	13.5		21	18	3.8	3.5	2.9	10.3
	40			3.8	7.1	3.0	13.9				3.9	3.6	3.0	10.5
	60			3.9	7.2	3.1	14.2				4.0	3.7	3.1	10.8
	80			4.0	7.4	3.1	14.5				4.1	3.8	3.2	11.1
15	20	35	27	5.6	10.3	4.4	20.4		63	27	5.7	11.3	3.9	21.0
	40			5.8	10.6	4.6	20.9				5.9	11.6	3.9	21.4
	60			5.9	10.8	4.7	21.4				6.0	11.9	3.9	21.9
	80			6.0	11.1	4.9	21.9				6.1	12.2	4.0	22.3
20	20	72	36	7.5	22.7	5.2	35.4		72	36	7.7	15.1	5.2	28.0
	40			7.7	23.1	5.3	36.0				7.8	15.5	5.3	28.6
	60			7.8	23.6	5.3	36.6				8.0	15.9	5.3	29.2
	80			8.0	24.0	5.3	37.3				8.2	16.3	5.3	29.7
25	20	90	45	9.4	28.3	6.6	44.3		81	45	9.6	18.9	7.4	35.9
	40			9.6	28.9	6.6	45.0				9.8	19.4	7.5	36.7
	60			9.8	29.5	6.6	45.8				10.0	19.9	7.7	37.6
	80			10.0	30.0	6.6	46.6				10.2	20.3	7.9	38.5
30	20	108	54	11.3	34.0	7.9	53.2		90	54	11.5	22.7	8.9	43.1
	40			11.5	34.7	7.9	54.1				11.7	23.3	9.0	44.0
	60			11.7	35.3	7.9	55.0				12.0	23.8	9.2	45.1
	80			12.0	36.0	7.9	55.9				12.3	24.4	9.5	46.1
35	20	126	63	13.2	39.7	9.2	62.0		99	63	13.4	26.5	10.4	50.3
	40			13.4	40.4	9.2	63.1				13.7	27.1	10.5	51.4
	60			13.7	41.2	9.2	64.1				14.0	27.8	10.8	52.6
	80			14.0	42.0	9.2	65.2				14.3	28.5	11.0	53.8
40	20	136	72	15.1	45.3	11.6	72.0		108	72	15.3	30.3	11.9	57.5
	40			15.3	46.2	11.8	73.3				15.7	31.0	12.0	58.7
	60			15.6	47.1	12.1	74.8				16.0	31.8	12.3	60.1
	80			16.0	48.1	12.3	76.3				16.4	32.5	12.6	61.5
45	20	145	81	16.9	51.0	13.1	81.0		117	81	17.2	34.0	15.3	66.5
	40			17.3	52.0	13.2	82.5				17.6	34.9	15.7	68.2
	60			17.6	53.0	13.6	84.2				18.0	35.7	16.1	69.9
	80			17.9	54.1	13.9	85.9				18.4	36.6	16.5	71.5
50	20	154	90	18.8	56.7	14.5	90.0		126	90	19.1	37.8	17.0	73.9
	40			19.2	57.8	14.7	91.7				19.6	38.8	17.4	75.8
	60			19.5	58.9	15.1	93.5				20.0	39.7	17.9	77.6
	80			19.9	60.1	15.4	95.4				20.5	40.7	18.3	79.5
55	20	163	99	20.7	62.3	16.0	99.0		135	99	21.0	41.6	18.7	81.3
	40			21.1	63.6	16.2	100.8				21.5	42.6	19.2	83.3
	60			21.5	64.8	16.6	102.9				22.0	43.7	19.7	85.4
	80			21.9	66.1	17.0	105.0				22.5	44.8	20.2	87.4
60	20	172	108	22.6	68.0	17.5	108.0		144	108	23.0	45.4	20.4	88.7
	40			23.0	69.3	17.6	110.0				23.5	46.5	20.9	90.9
	60			23.5	70.7	18.1	112.2				24.0	47.7	21.5	93.1
	80			23.9	72.1	18.5	114.5				24.6	48.8	22.0	95.4
70	20	189	125	26.4	79.3	20.4	126.1		161	125	26.8	52.9	24.2	103.9
	40			26.9	80.9	20.6	128.3				27.4	54.3	24.9	106.5
	60			27.4	82.5	21.1	130.9				28.0	55.6	25.6	109.2
	80			27.9	84.1	21.6	133.6				28.7	57.0	26.3	111.9
80	20	207	143	30.1	90.7	26.1	146.9		179	143	30.6	60.5	27.7	118.8
	40			30.7	92.4	26.9	150.0				31.3	62.0	28.4	121.8
	60			31.3	94.3	27.6	153.1				32.0	63.5	29.2	124.8
	80			31.9	96.1	28.3	156.3				32.8	65.1	30.0	127.9
90	20	225	161	33.9	102.0	29.4	165.3		197	161	34.4	68.1	37.6	140.1
	40			34.5	104.0	30.2	168.7				35.2	69.8	38.6	143.6
	60			35.2	106.0	31.0	172.2				36.0	71.5	39.7	147.2
	80			35.9	108.1	31.8	175.8				36.9	73.2	40.7	150.8
100	20	243	179	37.6	113.3	32.7	183.7		215	179	38.3	75.6	41.8	155.7
	40			38.4	115.6	33.6	187.5				39.2	77.5	42.9	159.6
	60			39.1	117.8	34.5	191.4				40.1	79.4	44.1	163.6
	80			39.9	120.1	35.4	195.4				41.0	81.4	45.2	167.6

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	2.4	4.5	1.8	8.7		16	13	2.4	2.3	2.2	6.9
	40			2.4	4.6	1.8	8.9				2.5	2.4	2.2	7.0
	60			2.4	4.7	1.8	9.0				2.5	2.4	2.3	7.2
	80			2.5	4.8	1.8	9.1				2.6	2.5	2.3	7.3
10	20	33	25	4.8	9.1	3.8	17.7		61	25	4.8	10.1	3.5	18.4
	40			4.8	9.3	3.9	18.0				4.9	10.3	3.5	18.7
	60			4.9	9.5	4.0	18.3				5.0	10.5	3.5	19.0
	80			4.9	9.6	4.1	18.7				5.1	10.6	3.5	19.2
15	20	76	38	7.2	22.8	5.2	35.2		74	38	7.3	15.1	6.0	28.4
	40			7.2	23.1	5.2	35.6				7.4	15.4	6.0	28.9
	60			7.3	23.5	5.2	36.0				7.5	15.7	6.1	29.3
	80			7.4	23.8	5.2	36.5				7.7	16.0	6.1	29.8
20	20	100	50	9.5	30.4	6.9	46.9		86	50	9.7	20.2	8.0	37.9
	40			9.7	30.9	6.9	47.5				9.9	20.6	8.1	38.5
	60			9.8	31.3	7.0	48.0				10.0	20.9	8.1	39.0
	80			9.9	31.7	7.0	48.6				10.2	21.3	8.2	39.7
25	20	126	63	11.9	38.0	8.7	58.6		99	63	12.1	25.2	10.1	47.4
	40			12.1	38.6	8.7	59.3				12.3	25.7	10.1	48.1
	60			12.2	39.1	8.7	60.0				12.5	26.1	10.1	48.8
	80			12.4	39.7	8.7	60.8				12.8	26.6	10.2	49.6
30	20	139	75	14.3	45.7	11.8	71.7		111	75	14.5	30.3	13.7	58.5
	40			14.5	46.3	11.8	72.5				14.8	30.8	14.0	59.6
	60			14.7	46.9	11.8	73.4				15.1	31.4	14.2	60.7
	80			14.8	47.6	11.9	74.4				15.3	31.9	14.5	61.8
35	20	152	88	16.7	53.3	13.7	83.7		124	88	17.0	35.3	16.0	68.3
	40			16.9	54.0	13.7	84.6				17.3	36.0	16.3	69.5
	60			17.1	54.8	13.8	85.6				17.6	36.6	16.6	70.8
	80			17.3	55.5	13.9	86.8				17.9	37.3	16.9	72.0
40	20	164	100	19.1	60.9	15.7	95.6		136	100	19.4	40.4	18.3	78.0
	40			19.3	61.7	15.7	96.7				19.7	41.1	18.6	79.4
	60			19.5	62.6	15.7	97.9				20.1	41.8	19.0	80.9
	80			19.8	63.5	15.9	99.2				20.4	42.6	19.3	82.3
45	20	177	113	21.5	68.5	17.6	107.6		149	113	21.8	45.4	20.9	88.1
	40			21.7	69.4	17.7	108.8				22.2	46.2	21.3	89.7
	60			22.0	70.4	17.7	110.1				22.6	47.1	21.8	91.4
	80			22.3	71.4	17.9	111.6				23.0	47.9	22.2	93.1
50	20	189	125	23.8	76.1	19.6	119.5		161	125	24.2	50.5	23.2	97.9
	40			24.1	77.2	19.6	120.9				24.7	51.4	23.7	99.7
	60			24.4	78.2	19.6	122.3				25.1	52.3	24.2	101.6
	80			24.7	79.4	19.9	124.0				25.5	53.2	24.7	103.4
55	20	202	138	26.2	83.7	24.0	133.9		174	138	26.7	55.5	25.5	107.7
	40			26.6	84.9	24.4	135.9				27.1	56.5	26.0	109.7
	60			26.9	86.1	24.9	137.9				27.6	57.5	26.6	111.7
	80			27.2	87.3	25.4	139.9				28.1	58.6	27.1	113.8
60	20	214	150	28.6	91.3	26.2	146.1		186	150	29.1	60.6	34.6	124.3
	40			29.0	92.6	26.7	148.2				29.6	61.7	35.3	126.6
	60			29.3	93.9	27.2	150.4				30.1	62.8	36.0	128.9
	80			29.7	95.2	27.8	152.7				30.6	63.9	36.7	131.2
65	20	227	163	31.0	98.9	28.4	158.3		199	163	31.5	65.6	37.5	134.6
	40			31.4	100.3	28.9	160.6				32.1	66.8	38.3	137.1
	60			31.8	101.7	29.5	163.0				32.6	68.0	39.0	139.6
	80			32.2	103.2	30.1	165.4				33.2	69.2	39.8	142.2
70	20	239	175	33.4	106.5	30.5	170.4		211	175	33.9	70.7	40.4	145.0
	40			33.8	108.0	31.1	172.9				34.5	71.9	41.2	147.7
	60			34.2	109.5	31.7	175.5				35.1	73.2	42.0	150.4
	80			34.6	111.1	32.4	178.1				35.7	74.5	42.9	153.1
75	20	247	192	35.8	114.1	32.7	182.6		224	188	36.4	75.7	43.3	155.4
	40			36.2	115.7	33.3	185.3				37.0	77.1	44.2	158.2
	60			36.7	117.4	34.0	188.0				37.6	78.4	45.0	161.1
	80			37.1	119.0	34.7	190.8				38.3	79.9	45.9	164.1

## 750 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	3.6	7.2	3.0	13.8	57	21	3.6	8.0	2.5	14.1
	40			3.6	7.3	3.0	13.9			3.7	8.1	2.5	14.3
	60			3.6	7.4	3.0	14.0			3.7	8.2	2.8	14.7
	80			3.6	7.4	3.0	14.1			3.7	8.3	2.8	14.8
10	20	84	42	7.2	24.3	4.9	36.5	78	42	7.3	16.1	6.5	29.8
	40			7.2	24.6	4.9	36.7			7.3	16.2	6.5	30.1
	60			7.2	24.8	5.5	37.5			7.4	16.4	6.5	30.3
	80			7.3	25.0	5.5	37.8			7.4	16.6	6.5	30.6
15	20	126	63	10.8	36.5	7.4	54.7	99	63	10.9	24.1	9.8	44.8
	40			10.8	36.8	7.4	55.1			11.0	24.4	9.8	45.1
	60			10.9	37.2	8.3	56.3			11.1	24.6	9.8	45.5
	80			10.9	37.5	8.3	56.7			11.2	24.9	9.8	45.9
20	20	148	84	14.4	48.7	12.6	75.7	120	84	14.5	32.1	15.1	61.8
	40			14.4	49.1	12.6	76.2			14.7	32.5	15.1	62.3
	60			14.5	49.5	12.7	76.7			14.8	32.9	15.1	62.8
	80			14.5	50.0	12.7	77.2			14.9	33.2	15.2	63.3
25	20	169	105	17.9	60.9	15.8	94.6	141	105	18.2	40.2	18.9	77.2
	40			18.0	61.4	15.8	95.2			18.3	40.6	18.9	77.8
	60			18.1	61.9	15.8	95.9			18.5	41.1	18.9	78.5
	80			18.2	62.5	15.9	96.5			18.6	41.5	19.0	79.1
30	20	189	125	21.5	73.0	18.9	113.5	161	125	21.8	48.2	22.7	92.7
	40			21.6	73.7	19.0	114.3			22.0	48.7	22.7	93.5
	60			21.7	74.3	19.0	115.0			22.2	49.3	22.9	94.4
	80			21.8	75.0	19.0	115.8			22.3	49.8	23.3	95.4
40	20	231	167	28.7	97.4	28.7	154.8	203	167	29.1	64.3	38.5	131.9
	40			28.8	98.2	28.7	155.8			29.3	65.0	38.9	133.2
	60			29.0	99.1	28.7	156.8			29.5	65.7	39.4	134.6
	80			29.1	99.9	28.8	157.8			29.8	66.4	39.8	136.1
45	20	250	192	32.6	110.4	32.5	175.5	225	189	33.0	72.9	43.7	149.6
	40			32.7	111.4	32.6	176.6			33.2	73.7	44.1	151.0
	60			32.8	112.3	32.6	177.8			33.5	74.5	44.6	152.7
	80			33.0	113.3	32.7	179.0			33.8	75.3	45.2	154.3

## 1000 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	40	32	4.9	10.3	4.3	19.6	68	32	5.0	11.7	3.5	20.2
	40			4.9	10.4	4.3	19.7			5.0	11.7	3.5	20.3
	60			4.9	10.5	4.3	19.8			5.1	11.8	3.5	20.5
	80			4.9	10.6	4.3	19.9			5.1	11.9	3.6	20.6
10	20	126	63	9.9	35.3	7.1	52.3	99	63	10.0	23.3	8.9	42.3
	40			9.9	35.5	7.1	52.5			10.1	23.5	8.9	42.5
	60			9.9	35.8	7.1	52.7			10.1	23.7	9.7	43.5
	80			9.9	36.0	7.1	53.0			10.2	23.8	9.7	43.8
15	20	158	94	14.8	53.0	12.9	80.7	130	94	15.1	35.0	16.6	66.6
	40			14.8	53.3	12.9	81.0			15.1	35.2	17.7	68.1
	60			14.8	53.6	14.0	82.5			15.2	35.5	17.7	68.4
	80			14.8	54.0	14.1	82.8			15.3	35.8	17.8	68.8
20	20	189	125	19.8	70.7	17.1	107.6	161	125	20.1	46.6	22.3	89.0
	40			19.8	71.1	17.2	108.0			20.2	47.0	22.4	89.5
	60			19.8	71.5	18.7	110.0			20.3	47.3	22.4	90.0
	80			19.8	71.9	18.7	110.4			20.4	47.7	22.4	90.5
25	20	221	157	24.7	88.3	25.7	138.8	193	157	25.1	58.3	36.5	119.9
	40			24.7	88.8	27.7	141.2			25.2	58.7	36.5	120.5
	60			24.7	89.4	27.7	141.8			25.4	59.2	36.6	121.1
	80			24.7	89.9	27.7	142.4			25.5	59.6	36.9	122.0
30	20	247	192	29.6	106.0	30.9	166.5	224	188	30.1	69.9	43.8	143.8
	40			29.6	106.6	33.2	169.4			30.3	70.5	43.8	144.5
	60			29.6	107.3	33.2	170.1			30.4	71.0	43.9	145.3
	80			29.6	107.9	33.3	170.8			30.6	71.5	44.3	146.4

## 1500 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	1.7	3.6	1.3	6.6	16	13	1.7	1.8	1.4	4.9
	40			1.7	3.6	1.3	6.6			1.7	1.8	1.4	4.9
	60			1.7	3.7	1.4	6.8			1.7	1.8	1.4	4.9
	80			1.7	3.7	1.4	6.8			1.7	1.9	1.4	5.0
2	20	33	25	3.4	7.2	2.6	13.2	61	25	3.4	7.3	2.6	13.2
	40			3.4	7.3	2.8	13.5			3.4	7.3	2.6	13.3
	60			3.4	7.3	2.8	13.5			3.4	7.4	2.6	13.3
	80			3.4	7.4	2.8	13.6			3.4	7.4	2.6	13.4
3	20	76	38	5.1	16.3	3.8	25.2	74	38	5.1	10.9	3.8	19.8
	40			5.1	16.4	3.8	25.3			5.1	11.0	3.8	19.9
	60			5.1	16.5	3.9	25.5			5.1	11.1	4.2	20.3
	80			5.1	16.6	3.9	25.6			5.1	11.2	4.2	20.4
4	20	100	50	6.8	21.7	5.1	33.6	86	50	6.8	14.5	5.1	26.4
	40			6.8	21.9	5.1	33.8			6.8	14.6	5.1	26.6
	60			6.8	22.0	5.1	33.9			6.8	14.8	5.6	27.1
	80			6.8	22.1	5.2	34.1			6.8	14.9	5.6	27.3
5	20	126	63	8.5	27.1	6.4	42.0	99	63	8.5	18.2	6.4	33.0
	40			8.5	27.3	6.4	42.2			8.5	18.3	6.4	33.2
	60			8.5	27.5	6.4	42.4			8.5	18.4	7.0	33.9
	80			8.5	27.7	6.4	42.6			8.5	18.6	7.0	34.1
10	20	189	125	17.0	54.3	12.8	84.1	161	125	17.0	36.3	12.8	66.1
	40			17.0	54.7	12.8	84.4			17.0	36.6	14.0	67.5
	60			17.0	55.0	14.0	86.0			17.0	36.9	14.0	67.8
	80			17.0	55.4	14.0	86.4			17.0	37.2	14.0	68.1
15	20	247	192	25.5	81.4	19.2	126.1	224	188	25.4	54.5	19.2	99.1
	40			25.5	82.0	20.9	128.4			25.4	54.9	20.9	101.3
	60			25.5	82.5	21.0	128.9			25.4	55.3	21.0	101.7
	80			25.5	83.1	21.0	129.5			25.4	55.8	21.0	102.2

## 2000 CHARACTER DATA RECORD

1410/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	2.0	3.8	1.4	7.2	16	13	2.0	1.9	1.4	5.3
	40			2.0	3.8	1.4	7.2			2.0	1.9	1.4	5.3
	60			2.0	3.9	1.4	7.2			2.0	1.9	1.4	5.3
	80			2.0	3.9	1.4	7.3			2.0	2.0	1.4	5.3
2	20	33	25	3.9	7.6	2.8	14.4	61	25	3.9	7.6	2.8	14.4
	40			3.9	7.7	2.8	14.4			3.9	7.7	2.8	14.4
	60			3.9	7.7	2.8	14.5			3.9	7.8	2.8	14.5
	80			3.9	7.8	2.8	14.5			3.9	7.8	2.8	14.6
3	20	76	38	5.9	17.1	4.2	27.3	74	38	5.9	11.5	4.2	21.6
	40			5.9	17.2	4.2	27.4			5.9	11.5	4.2	21.7
	60			5.9	17.3	4.3	27.5			5.9	11.6	4.3	21.8
	80			5.9	17.5	4.3	27.6			5.9	11.7	4.3	21.9
4	20	100	50	7.8	22.8	5.7	36.3	86	50	7.8	15.3	5.7	28.8
	40			7.8	23.0	5.7	36.5			7.8	15.4	5.7	28.9
	60			7.8	23.1	5.7	36.7			7.8	15.5	5.7	29.0
	80			7.8	23.3	5.7	36.8			7.8	15.6	5.7	29.1
5	20	126	63	9.8	28.6	7.1	45.4	99	63	9.8	19.1	7.1	36.0
	40			9.8	28.7	7.1	45.6			9.8	19.2	7.1	36.1
	60			9.8	28.9	7.1	45.8			9.8	19.4	7.1	36.3
	80			9.8	29.1	7.1	46.0			9.8	19.5	7.1	36.4
10	20	189	125	19.6	57.1	14.1	90.8	161	125	19.6	38.2	14.1	71.9
	40			19.6	57.5	14.2	91.2			19.6	38.5	14.2	72.2
	60			19.6	57.8	14.2	91.6			19.6	38.8	14.2	72.6
	80			19.6	58.2	14.2	92.0			19.6	39.0	14.2	72.9
15	20	247	192	29.4	85.7	21.2	136.3	224	188	29.4	57.3	21.2	107.9
	40			29.4	86.2	21.2	136.9			29.4	57.7	21.2	108.4
	60			29.4	86.7	21.3	137.4			29.4	58.2	21.3	108.8
	80			29.4	87.3	21.3	138.0			29.4	58.6	21.3	109.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	1	1	.2	.0	.1	.3		1	1	.3	.0	.1	.3
	10			.3	.0	.1	.3				.3	.0	.1	.4
	15			.3	.0	.1	.4				.3	.0	.1	.4
10	5	2	1	.5	.2	.3	1.0		1	1	.5	.0	.3	.8
	10			.5	.2	.3	1.0				.5	.0	.3	.8
	15			.5	.2	.3	1.0				.5	.0	.3	.8
20	5	3	2	1.0	.4	.6	2.0		4	2	1.0	.5	.6	2.1
	10			1.0	.5	.6	2.0				1.1	.5	.6	2.1
	15			1.0	.5	.6	2.1				1.1	.5	.6	2.2
30	5	4	3	1.5	.7	.9	3.0		6	3	1.5	.7	.9	3.1
	10			1.5	.7	.9	3.1				1.6	.8	.9	3.2
	15			1.5	.7	.9	3.1				1.6	.8	.9	3.3
40	5	5	4	1.9	.9	1.2	4.0		7	4	2.0	1.0	1.2	4.2
	10			2.0	.9	1.2	4.1				2.1	1.0	1.2	4.3
	15			2.1	.9	1.2	4.2				2.2	1.0	1.2	4.4
50	5	13	5	2.4	2.2	1.4	6.1		8	5	2.6	1.2	1.5	5.2
	10			2.5	2.3	1.4	6.2				2.6	1.3	1.5	5.4
	15			2.6	2.4	1.4	6.4				2.7	1.3	1.5	5.5
75	5	15	7	3.6	3.4	2.1	9.1		10	7	3.8	1.8	2.2	7.9
	10			3.8	3.5	2.1	9.4				4.0	1.9	2.2	8.1
	15			3.9	3.6	2.1	9.6				4.1	2.0	2.2	8.3
100	5	17	9	4.9	4.5	2.9	12.2		12	9	5.1	2.4	2.9	10.5
	10			5.0	4.6	2.9	12.5				5.3	2.5	2.9	10.8
	15			5.2	4.8	2.9	12.8				5.5	2.6	3.0	11.0
125	5	20	12	6.1	5.6	3.6	15.3		15	12	6.4	3.0	3.7	13.1
	10			6.3	5.8	3.6	15.7				6.6	3.1	3.7	13.5
	15			6.5	6.0	3.6	16.1				6.8	3.3	3.7	13.8
150	5	22	14	7.3	6.7	4.3	18.3		17	14	7.7	3.6	4.5	15.8
	10			7.5	6.9	4.4	18.8				7.9	3.8	4.5	16.2
	15			7.7	7.2	4.4	19.3				8.2	3.9	4.5	16.7
175	5	24	16	8.5	7.8	5.1	21.4		19	16	8.9	4.2	5.3	18.4
	10			8.8	8.1	5.1	21.9				9.3	4.4	5.3	18.9
	15			9.0	8.3	5.1	22.5				9.6	4.6	5.3	19.4
200	5	26	18	9.7	9.0	5.9	24.5		21	18	10.2	4.9	6.0	21.1
	10			10.0	9.2	5.9	25.1				10.6	5.0	6.0	21.6
	15			10.3	9.5	5.9	25.8				10.9	5.2	6.0	22.2
250	5	31	23	12.1	11.2	7.3	30.7		59	23	12.8	12.8	7.1	32.7
	10			12.5	11.6	7.3	31.4				13.2	13.2	7.2	33.6
	15			12.9	11.9	7.4	32.2				13.7	13.6	7.2	34.5
300	5	35	27	14.6	13.4	8.8	36.8		63	27	15.3	15.3	8.6	39.2
	10			15.0	13.9	8.8	37.7				15.9	15.8	8.6	40.3
	15			15.5	14.3	8.9	38.7				16.4	16.3	8.6	41.3
350	5	40	32	17.0	15.7	10.3	43.0		68	32	17.9	17.9	10.0	45.8
	10			17.5	16.2	10.3	44.0				18.5	18.5	10.0	47.0
	15			18.1	16.7	10.3	45.1				19.1	19.1	10.0	48.2
400	5	72	36	19.4	28.3	11.4	59.1		72	36	20.4	20.5	11.4	52.3
	10			20.0	29.1	11.4	60.6				21.2	21.1	11.4	53.7
	15			20.7	29.9	11.5	62.0				21.9	21.8	11.5	55.1



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.3	.1	.2	.6		1	1	.3	.0	.2	.5
	10			.3	.1	.2	.7				.3	.0	.2	.5
	15			.3	.1	.2	.7				.3	.0	.2	.5
	20			.3	.1	.2	.7				.3	.0	.2	.5
10	5	3	2	.6	.3	.4	1.3		2	1	.6	.0	.4	1.0
	10			.6	.3	.4	1.3				.6	.0	.4	1.0
	15			.6	.3	.4	1.3				.6	.0	.4	1.0
	20			.6	.3	.4	1.4				.7	.0	.4	1.0
20	5	4	3	1.2	.5	.9	2.6		6	3	1.2	.6	.8	2.7
	10			1.2	.6	.9	2.6				1.2	.6	.8	2.7
	15			1.3	.6	.9	2.7				1.3	.6	.9	2.8
	20			1.3	.6	.9	2.7				1.3	.7	.9	2.8
30	5	13	5	1.8	1.7	1.3	4.8		8	5	1.8	.9	1.3	4.0
	10			1.8	1.7	1.3	4.8				1.9	.9	1.3	4.1
	15			1.9	1.8	1.3	4.9				1.9	1.0	1.3	4.2
	20			1.9	1.8	1.3	5.0				2.0	1.0	1.3	4.2
40	5	14	6	2.4	2.3	1.7	6.4		9	6	2.4	1.2	1.7	5.3
	10			2.5	2.3	1.7	6.5				2.5	1.2	1.7	5.4
	15			2.5	2.4	1.7	6.6				2.6	1.3	1.7	5.5
	20			2.6	2.4	1.7	6.7				2.6	1.3	1.7	5.7
50	5	15	7	3.0	2.8	2.1	7.9		10	7	3.0	1.5	2.2	6.7
	10			3.1	2.9	2.1	8.1				3.1	1.5	2.2	6.8
	15			3.1	3.0	2.1	8.2				3.2	1.6	2.2	7.0
	20			3.2	3.0	2.1	8.4				3.3	1.6	2.2	7.1
75	5	19	11	4.5	4.2	3.2	12.0		14	11	4.5	2.2	3.3	10.1
	10			4.6	4.3	3.2	12.2				4.7	2.3	3.3	10.3
	15			4.7	4.4	3.2	12.4				4.8	2.4	3.3	10.5
	20			4.8	4.5	3.2	12.6				4.9	2.4	3.3	10.7
100	5	22	14	6.0	5.7	4.3	15.9		17	14	6.1	3.0	4.5	13.5
	10			6.1	5.8	4.3	16.2				6.2	3.1	4.5	13.8
	15			6.3	5.9	4.3	16.5				6.4	3.2	4.5	14.0
	20			6.5	6.0	4.3	16.8				6.6	3.3	4.5	14.3
125	5	25	17	7.5	7.1	5.4	20.0		20	17	7.6	3.7	5.6	16.9
	10			7.7	7.2	5.4	20.3				7.8	3.9	5.6	17.2
	15			7.9	7.4	5.4	20.7				8.0	4.0	5.6	17.5
	20			8.1	7.6	5.5	21.1				8.2	4.1	5.6	17.9
150	5	29	21	9.0	8.5	6.5	24.0		57	21	9.1	9.8	6.4	25.3
	10			9.2	8.6	6.5	24.4				9.3	10.0	6.4	25.7
	15			9.4	8.9	6.5	24.8				9.6	10.3	6.4	26.2
	20			9.7	9.1	6.5	25.3				9.8	10.5	6.4	26.7
175	5	32	24	10.5	9.9	7.6	28.0		60	24	10.6	11.4	7.4	29.5
	10			10.7	10.1	7.6	28.4				10.9	11.7	7.4	30.0
	15			11.0	10.3	7.6	29.0				11.2	12.0	7.4	30.6
	20			11.3	10.6	7.6	29.5				11.5	12.2	7.5	31.2
200	5	35	27	12.0	11.3	8.7	32.0		63	27	12.1	13.1	8.5	33.7
	10			12.3	11.5	8.7	32.5				12.4	13.4	8.5	34.3
	15			12.6	11.8	8.7	33.1				12.8	13.7	8.5	35.0
	20			12.9	12.1	8.8	33.7				13.1	14.0	8.5	35.6
250	5	68	34	15.0	23.1	10.6	48.6		70	34	15.1	16.3	10.6	42.1
	10			15.4	23.4	10.6	49.3				15.6	16.7	10.6	42.9
	15			15.7	23.8	10.6	50.2				16.0	17.1	10.6	43.7
	20			16.1	24.3	10.6	51.0				16.4	17.5	10.6	44.5
300	5	82	41	18.0	27.7	12.7	58.4		77	41	18.2	19.6	13.2	51.0
	10			18.4	28.0	12.7	59.2				18.7	20.1	13.2	51.9
	15			18.9	28.6	12.8	60.2				19.2	20.5	13.2	52.9
	20			19.4	29.1	12.8	61.2				19.7	21.0	13.3	53.9
350	5	96	48	20.9	32.3	14.9	68.1		84	48	21.2	22.9	15.4	59.5
	10			21.5	32.7	14.9	69.1				21.8	23.4	15.4	60.6
	15			22.0	33.3	14.9	70.3				22.4	23.9	15.4	61.7
	20			22.6	34.0	14.9	71.5				23.0	24.5	15.5	62.9
400	5	108	54	23.9	36.9	17.0	77.8		90	54	24.2	26.2	17.6	68.0
	10			24.6	37.4	17.0	79.0				24.9	26.7	17.6	69.3
	15			25.2	38.1	17.0	80.3				25.6	27.3	17.6	70.6
	20			25.8	38.8	17.0	81.7				26.2	28.0	17.7	71.9

## 40 CHARACTER DATA RECORD

7010/1301 DISK INPUT AND OUTPUT 7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.4	.2	.3	.8	1	1	.4	.0	.3	.6
	10			.4	.2	.3	.8			.4	.0	.3	.6
	15			.4	.2	.3	.8			.4	.0	.3	.6
	20			.4	.2	.3	.8			.4	.0	.3	.6
10	5	3	2	.7	.4	.6	1.6	4	2	.7	.4	.6	1.6
	10			.7	.4	.6	1.6			.7	.4	.6	1.7
	15			.7	.4	.6	1.7			.7	.4	.6	1.7
	20			.7	.4	.6	1.7			.8	.4	.6	1.7
20	5	5	4	1.4	.7	1.1	3.3	7	4	1.4	.7	1.1	3.3
	10			1.5	.7	1.1	3.3			1.5	.7	1.1	3.3
	15			1.5	.7	1.1	3.3			1.5	.7	1.1	3.4
	20			1.5	.7	1.1	3.3			1.5	.8	1.1	3.4
30	5	14	6	2.2	2.2	1.7	6.1	9	6	2.2	1.1	1.7	5.0
	10			2.2	2.2	1.7	6.1			2.2	1.1	1.7	5.0
	15			2.2	2.3	1.7	6.1			2.2	1.1	1.7	5.1
	20			2.2	2.3	1.7	6.2			2.3	1.1	1.7	5.1
40	5	16	8	2.9	3.0	2.2	8.1	11	8	2.9	1.5	2.3	6.7
	10			2.9	3.0	2.3	8.2			2.9	1.5	2.3	6.7
	15			2.9	3.0	2.3	8.2			3.0	1.5	2.3	6.8
	20			3.0	3.0	2.3	8.2			3.0	1.5	2.3	6.9
50	5	17	9	3.6	3.7	2.8	10.2	12	9	3.6	1.9	2.9	8.3
	10			3.6	3.7	2.8	10.2			3.6	1.9	2.9	8.4
	15			3.7	3.8	2.8	10.3			3.7	1.9	2.9	8.5
	20			3.7	3.8	2.9	10.3			3.8	1.9	2.9	8.6
75	5	22	14	5.4	5.6	4.3	15.3	17	14	5.4	2.8	4.4	12.6
	10			5.4	5.6	4.3	15.3			5.4	2.8	4.4	12.6
	15			5.5	5.6	4.3	15.4			5.6	2.8	4.4	12.8
	20			5.6	5.6	4.3	15.5			5.7	2.9	4.4	13.0
100	5	26	18	7.2	7.5	5.7	20.4	21	18	7.2	3.7	5.9	16.8
	10			7.3	7.5	5.8	20.5			7.3	3.7	5.9	16.9
	15			7.3	7.5	5.8	20.6			7.4	3.7	5.9	17.0
	20			7.4	7.5	5.8	20.7			7.6	3.8	5.9	17.3
125	5	31	23	9.0	9.3	7.2	25.5	59	23	9.0	10.4	7.0	26.4
	10			9.1	9.4	7.2	25.6			9.1	10.4	7.0	26.5
	15			9.2	9.4	7.2	25.8			9.3	10.4	7.0	26.7
	20			9.3	9.4	7.2	25.9			9.5	10.5	7.0	27.0
150	5	35	27	10.8	11.2	8.6	30.6	63	27	10.8	12.5	8.4	31.7
	10			10.9	11.2	8.6	30.8			10.9	12.4	8.4	31.8
	15			11.0	11.3	8.7	30.9			11.1	12.4	8.4	32.0
	20			11.2	11.3	8.7	31.1			11.4	12.6	8.5	32.4
175	5	40	32	12.6	13.1	10.1	35.7	68	32	12.6	14.6	9.8	36.9
	10			12.7	13.1	10.1	35.9			12.7	14.5	9.8	37.0
	15			12.9	13.1	10.1	36.1			13.0	14.5	9.9	37.3
	20			13.0	13.1	10.1	36.3			13.2	14.8	9.9	37.9
200	5	72	36	14.3	24.6	11.2	50.2	72	36	14.3	16.6	11.2	42.2
	10			14.5	24.7	11.3	50.4			14.5	16.6	11.3	42.3
	15			14.7	24.7	11.3	50.7			14.8	16.6	11.3	42.7
	20			14.9	24.7	11.3	50.8			15.1	16.9	11.3	43.3
250	5	90	45	17.9	30.8	14.1	62.8	81	45	17.9	20.8	14.6	53.3
	10			18.2	30.8	14.1	63.1			18.2	20.7	14.6	53.4
	15			18.4	30.9	14.1	63.3			18.5	20.7	14.6	53.8
	20			18.6	30.8	14.1	63.5			18.9	21.1	14.6	54.6
300	5	108	54	21.5	36.9	16.9	75.3	90	54	21.5	24.9	17.5	63.9
	10			21.8	37.0	16.9	75.7			21.8	24.8	17.5	64.1
	15			22.0	37.0	16.9	76.0			22.2	24.9	17.5	64.6
	20			22.3	37.0	16.9	76.2			22.7	25.3	17.5	65.5
350	5	126	63	25.1	43.1	19.7	87.9	99	63	25.1	29.1	20.4	74.6
	10			25.4	43.2	19.7	88.3			25.4	29.0	20.4	74.8
	15			25.7	43.2	19.7	88.7			25.9	29.0	20.4	75.4
	20			26.1	43.2	19.7	89.0			26.5	29.5	20.4	76.4
400	5	136	72	28.7	49.3	23.0	101.0	108	72	28.7	33.3	23.3	85.2
	10			29.0	49.3	23.1	101.4			29.1	33.1	23.3	85.5
	15			29.4	49.4	23.1	101.9			29.6	33.2	23.3	86.2
	20			29.8	49.3	23.1	102.2			30.3	33.7	23.4	87.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.4	.2	.4	1.0		2	1	.4	.0	.4	.7
	20			.4	.2	.4	1.0				.4	.0	.4	.7
	30			.5	.2	.4	1.0				.5	.0	.4	.8
	40			.5	.2	.4	1.0				.5	.0	.4	.8
10	10	4	3	.9	.4	.7	2.0		6	3	.9	.5	.7	2.0
	20			.9	.4	.7	2.0				.9	.5	.7	2.0
	30			.9	.4	.7	2.1				.9	.5	.7	2.1
	40			.9	.4	.7	2.1				.9	.5	.7	2.1
20	10	13	5	1.7	1.9	1.4	5.0		8	5	1.7	.9	1.4	4.1
	20			1.8	1.9	1.4	5.0				1.8	.9	1.4	4.1
	30			1.8	1.9	1.4	5.1				1.8	.9	1.4	4.2
	40			1.8	1.9	1.4	5.1				1.9	.9	1.4	4.2
30	10	15	7	2.6	2.8	2.1	7.5		10	7	2.6	1.4	2.2	6.1
	20			2.7	2.8	2.1	7.6				2.7	1.4	2.2	6.2
	30			2.7	2.8	2.1	7.6				2.7	1.4	2.2	6.3
	40			2.8	2.8	2.1	7.7				2.8	1.4	2.2	6.4
40	10	17	9	3.5	3.7	2.8	10.0		12	9	3.5	1.8	2.9	8.2
	20			3.5	3.7	2.8	10.1				3.5	1.8	2.9	8.3
	30			3.6	3.7	2.8	10.2				3.6	1.9	2.9	8.3
	40			3.7	3.8	2.8	10.3				3.7	1.9	2.9	8.5
50	10	20	12	4.3	4.7	3.5	12.5		15	12	4.3	2.3	3.6	10.2
	20			4.4	4.7	3.5	12.6				4.4	2.3	3.6	10.3
	30			4.5	4.7	3.6	12.7				4.5	2.3	3.6	10.4
	40			4.6	4.7	3.6	12.8				4.7	2.4	3.6	10.6
75	10	25	17	6.5	7.0	5.4	18.8		20	17	6.5	3.5	5.4	15.3
	20			6.6	7.0	5.4	19.0				6.6	3.5	5.4	15.5
	30			6.8	7.0	5.4	19.2				6.8	3.5	5.4	15.7
	40			6.9	7.0	5.4	19.3				7.0	3.6	5.4	16.0
100	10	31	23	8.7	9.3	7.2	25.1		59	23	8.7	10.4	7.0	26.0
	20			8.8	9.3	7.2	25.3				8.8	10.4	7.0	26.3
	30			9.0	9.4	7.2	25.6				9.0	10.4	7.0	26.4
	40			9.2	9.4	7.2	25.8				9.3	10.5	7.0	26.8
125	10	36	28	10.8	11.6	9.0	31.4		64	28	10.8	13.0	8.8	32.6
	20			11.0	11.7	9.0	31.7				11.1	13.0	8.8	32.8
	30			11.3	11.7	9.0	32.0				11.3	12.9	8.8	33.0
	40			11.5	11.7	9.0	32.2				11.6	13.1	8.8	33.5
150	10	68	34	13.0	23.0	10.5	46.5		70	34	13.0	15.5	10.5	39.1
	20			13.3	23.1	10.5	46.9				13.3	15.6	10.5	39.4
	30			13.5	23.1	10.5	47.2				13.5	15.5	10.5	39.6
	40			13.8	23.2	10.6	47.5				14.0	15.7	10.6	40.2
175	10	80	40	15.2	26.9	12.3	54.3		76	40	15.2	18.1	12.7	46.0
	20			15.5	26.9	12.3	54.7				15.5	18.2	12.7	46.4
	30			15.8	27.0	12.3	55.0				15.8	18.1	12.7	46.7
	40			16.1	27.0	12.3	55.4				16.3	18.3	12.8	47.4
200	10	90	45	17.3	30.7	14.0	62.1		81	45	17.3	20.7	14.5	52.6
	20			17.7	30.8	14.0	62.5				17.7	20.8	14.5	53.0
	30			18.0	30.8	14.1	62.9				18.0	20.7	14.6	53.3
	40			18.4	30.9	14.1	63.3				18.6	21.0	14.6	54.2
250	10	112	56	21.7	38.4	17.5	77.6		92	56	21.7	25.9	18.1	65.7
	20			22.1	38.5	17.5	78.1				22.1	26.0	18.2	66.3
	30			22.5	38.5	17.6	78.6				22.6	25.9	18.2	66.6
	40			23.0	38.6	17.6	79.2				23.3	26.2	18.2	67.7
300	10	131	67	26.0	46.1	21.5	93.6		103	67	26.0	31.1	21.8	78.9
	20			26.5	46.2	21.6	94.2				26.5	31.2	21.8	79.5
	30			27.0	46.3	21.6	94.9				27.1	31.1	21.8	80.0
	40			27.5	46.3	21.6	95.5				27.9	31.4	21.9	81.3
350	10	143	79	30.3	53.7	25.1	109.2		115	79	30.4	36.3	26.3	92.9
	20			30.9	53.8	25.2	109.9				31.0	36.4	26.3	93.6
	30			31.5	54.0	25.2	110.7				31.6	36.2	26.4	94.2
	40			32.1	54.1	25.2	111.5				32.6	36.7	26.4	95.7
400	10	154	90	34.7	61.4	28.7	124.8		126	90	34.7	41.4	30.0	106.1
	20			35.4	61.5	28.8	125.6				35.4	41.5	30.1	107.0
	30			36.0	61.7	28.8	126.5				36.1	41.4	30.1	107.6
	40			36.7	61.8	28.9	127.4				37.3	41.9	30.2	109.4

## 60 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.5	.3	.4	1.2	2	1	.5	.0	.4	.9
	20			.5	.3	.4	1.2			.5	.0	.4	.9
	30			.5	.3	.4	1.2			.5	.0	.4	.9
	40			.5	.3	.4	1.2			.5	.0	.4	.9
10	10	4	3	1.0	.5	.9	2.4	6	3	1.0	.6	.8	2.4
	20			1.0	.5	.9	2.4			1.0	.6	.8	2.4
	30			1.0	.5	.9	2.4			1.0	.6	.8	2.5
	40			1.1	.5	.9	2.5			1.1	.6	.8	2.5
20	10	14	6	2.0	2.3	1.7	6.0	9	6	2.0	1.1	1.7	4.8
	20			2.1	2.3	1.7	6.0			2.1	1.1	1.7	4.9
	30			2.1	2.3	1.7	6.1			2.1	1.1	1.7	4.9
	40			2.1	2.3	1.7	6.1			2.1	1.1	1.7	5.0
30	10	17	9	3.0	3.4	2.6	9.0	12	9	3.0	1.7	2.6	7.3
	20			3.1	3.4	2.6	9.0			3.1	1.7	2.6	7.4
	30			3.1	3.4	2.6	9.1			3.1	1.7	2.6	7.4
	40			3.2	3.4	2.6	9.2			3.2	1.7	2.6	7.5
40	10	19	11	4.0	4.5	3.4	12.0	14	11	4.1	2.2	3.5	9.7
	20			4.1	4.5	3.4	12.1			4.1	2.2	3.5	9.8
	30			4.2	4.5	3.4	12.1			4.2	2.2	3.5	9.9
	40			4.3	4.5	3.4	12.2			4.3	2.3	3.5	10.0
50	10	22	14	5.1	5.6	4.3	15.0	17	14	5.1	2.8	4.4	12.3
	20			5.1	5.7	4.3	15.1			5.2	2.8	4.4	12.4
	30			5.2	5.7	4.3	15.2			5.2	2.8	4.4	12.5
	40			5.3	5.7	4.3	15.3			5.3	2.8	4.4	12.6
75	10	29	21	7.6	8.5	6.5	22.5	57	21	7.6	9.4	6.3	23.4
	20			7.7	8.5	6.5	22.7			7.7	9.4	6.3	23.5
	30			7.8	8.5	6.5	22.8			7.9	9.5	6.3	23.7
	40			8.0	8.5	6.5	23.0			8.0	9.5	6.3	23.8
100	10	36	28	10.1	11.3	8.6	30.0	64	28	10.1	12.6	8.4	31.1
	20			10.3	11.3	8.6	30.2			10.3	12.6	8.4	31.4
	30			10.5	11.3	8.7	30.5			10.5	12.6	8.5	31.6
	40			10.6	11.4	8.7	30.7			10.7	12.6	8.5	31.8
125	10	68	34	12.6	23.3	10.5	46.5	70	34	12.7	15.7	10.5	38.9
	20			12.9	23.3	10.6	46.8			12.9	15.7	10.6	39.2
	30			13.1	23.4	10.6	47.0			13.1	15.8	10.6	39.5
	40			13.3	23.4	10.6	47.3			13.3	15.8	10.6	39.7
150	10	82	41	15.2	27.9	12.7	55.8	77	41	15.2	18.9	13.1	47.2
	20			15.4	28.0	12.7	56.1			15.5	18.9	13.1	47.5
	30			15.7	28.0	12.7	56.4			15.7	18.9	13.1	47.8
	40			15.9	28.1	12.7	56.7			16.0	19.0	13.2	48.1
175	10	96	48	17.7	32.6	14.8	65.1	84	48	17.7	22.0	15.3	55.0
	20			18.0	32.7	14.8	65.5			18.0	22.0	15.3	55.4
	30			18.3	32.7	14.8	65.8			18.3	22.1	15.3	55.8
	40			18.6	32.8	14.8	66.2			18.7	22.1	15.4	56.1
200	10	110	55	20.2	37.3	16.9	74.4	91	55	20.3	25.1	17.5	62.9
	20			20.6	37.3	16.9	74.8			20.6	25.2	17.5	63.3
	30			20.9	37.4	16.9	75.2			21.0	25.2	17.5	63.7
	40			21.3	37.5	16.9	75.7			21.3	25.3	17.6	64.2
250	10	132	68	25.3	46.6	21.6	93.5	104	68	25.3	31.4	21.9	78.6
	20			25.7	46.7	21.6	94.0			25.8	31.5	21.9	79.1
	30			26.1	46.7	21.7	94.6			26.2	31.6	21.9	79.7
	40			26.6	46.8	21.7	95.1			26.6	31.6	21.9	80.2
300	10	146	82	30.4	55.9	25.9	112.2	118	82	30.4	37.7	27.1	95.2
	20			30.9	56.0	26.0	112.8			30.9	37.8	27.2	95.9
	30			31.4	56.1	26.0	113.5			31.4	37.9	27.2	96.5
	40			31.9	56.2	26.0	114.1			32.0	37.9	27.2	97.2
350	10	160	96	35.4	65.2	30.2	130.9	132	96	35.5	44.0	31.6	111.1
	20			36.0	65.3	30.3	131.6			36.1	44.1	31.7	111.8
	30			36.6	65.4	30.3	132.4			36.7	44.2	31.7	112.6
	40			37.2	65.6	30.4	133.1			37.3	44.3	31.8	113.4
400	10	173	109	40.5	74.5	34.6	149.6	145	109	40.5	50.3	36.2	127.0
	20			41.2	74.7	34.6	150.4			41.2	50.4	36.3	127.9
	30			41.8	74.8	34.7	151.3			41.9	50.5	36.3	128.7
	40			42.5	74.9	34.7	152.2			42.6	50.6	36.4	129.6

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.6	.3	.5	1.4		4	2	.6	.3	.5	1.4
	20			.6	.3	.5	1.4				.6	.3	.5	1.4
	30			.6	.3	.5	1.4				.6	.3	.5	1.4
	40			.6	.3	.5	1.4				.6	.3	.5	1.4
10	10	5	4	1.1	.6	1.0	2.7		7	4	1.1	.6	1.0	2.8
	20			1.2	.6	1.0	2.8				1.2	.6	1.0	2.8
	30			1.2	.6	1.0	2.8				1.2	.6	1.0	2.8
	40			1.2	.6	1.0	2.8				1.2	.6	1.0	2.8
20	10	15	7	2.3	2.6	2.0	6.8		10	7	2.3	1.3	2.0	5.6
	20			2.3	2.6	2.0	6.9				2.3	1.3	2.0	5.6
	30			2.4	2.6	2.0	6.9				2.4	1.3	2.0	5.7
	40			2.4	2.6	2.0	7.0				2.4	1.3	2.0	5.7
30	10	18	10	3.4	3.9	3.0	10.3		13	10	3.4	1.9	3.0	8.4
	20			3.5	3.9	3.0	10.4				3.5	1.9	3.0	8.4
	30			3.5	3.9	3.0	10.4				3.6	1.9	3.0	8.5
	40			3.6	3.9	3.0	10.5				3.6	1.9	3.0	8.6
40	10	21	13	4.6	5.2	3.9	13.7		16	13	4.6	2.6	4.1	11.2
	20			4.7	5.2	4.0	13.8				4.7	2.6	4.1	11.3
	30			4.7	5.2	4.0	13.9				4.7	2.6	4.1	11.4
	40			4.8	5.2	4.0	14.0				4.8	2.6	4.1	11.5
50	10	24	16	5.7	6.5	4.9	17.1		19	16	5.7	3.2	5.1	14.0
	20			5.8	6.5	4.9	17.3				5.8	3.2	5.1	14.1
	30			5.9	6.5	4.9	17.4				5.9	3.2	5.1	14.3
	40			6.0	6.5	5.0	17.5				6.0	3.2	5.1	14.4
75	10	32	24	8.6	9.7	7.5	25.8		60	24	8.6	10.8	7.3	26.8
	20			8.7	9.7	7.5	26.0				8.7	10.8	7.3	26.9
	30			8.9	9.7	7.5	26.1				8.9	10.9	7.3	27.1
	40			9.0	9.8	7.5	26.3				9.0	10.9	7.4	27.2
100	10	40	32	11.5	12.9	10.0	34.4		68	32	11.5	14.4	9.8	35.7
	20			11.7	13.0	10.0	34.6				11.7	14.5	9.8	35.9
	30			11.8	13.0	10.0	34.8				11.8	14.5	9.8	36.1
	40			12.0	13.0	10.0	35.1				12.0	14.5	9.8	36.3
125	10	80	40	14.4	26.7	12.2	53.3		76	40	14.4	18.0	12.6	45.0
	20			14.6	26.8	12.2	53.6				14.6	18.1	12.7	45.3
	30			14.8	26.8	12.2	53.8				14.8	18.1	12.7	45.6
	40			15.0	26.9	12.3	54.1				15.0	18.1	12.7	45.8
150	10	94	47	17.2	32.1	14.7	64.0		83	47	17.2	21.6	15.2	54.0
	20			17.5	32.1	14.7	64.3				17.5	21.7	15.2	54.4
	30			17.7	32.2	14.7	64.6				17.8	21.7	15.2	54.7
	40			18.0	32.2	14.7	64.9				18.0	21.8	15.2	55.0
175	10	110	55	20.1	37.4	17.1	74.6		91	55	20.1	25.2	17.7	63.1
	20			20.4	37.5	17.1	75.0				20.4	25.3	17.7	63.4
	30			20.7	37.5	17.1	75.4				20.7	25.3	17.7	63.8
	40			21.0	37.6	17.2	75.7				21.0	25.4	17.8	64.2
200	10	126	63	23.0	42.8	19.6	85.3		99	63	23.0	28.9	20.2	72.1
	20			23.3	42.8	19.6	85.7				23.3	28.9	20.3	72.5
	30			23.6	42.9	19.6	86.1				23.7	29.0	20.3	72.9
	40			24.0	43.0	19.6	86.6				24.0	29.0	20.3	73.3
250	10	143	79	28.7	53.5	25.0	107.2		115	79	28.7	36.1	26.1	90.9
	20			29.1	53.6	25.0	107.7				29.2	36.1	26.2	91.5
	30			29.6	53.6	25.1	108.3				29.6	36.2	26.2	92.0
	40			30.0	53.7	25.1	108.8				30.0	36.3	26.2	92.5
300	10	158	94	34.4	64.2	30.0	128.6		130	94	34.5	43.3	31.4	109.1
	20			35.0	64.3	30.0	129.3				35.0	43.4	31.4	109.7
	30			35.5	64.4	30.1	129.9				35.5	43.4	31.4	110.4
	40			36.0	64.5	30.1	130.6				36.0	43.5	31.5	111.0
350	10	174	110	40.2	74.9	35.0	150.1		146	110	40.2	50.5	36.6	127.3
	20			40.8	75.0	35.1	150.8				40.8	50.6	36.7	128.1
	30			41.4	75.1	35.1	151.6				41.4	50.7	36.7	128.8
	40			42.0	75.2	35.1	152.3				42.0	50.8	36.8	129.6
400	10	189	125	45.9	85.5	40.0	171.5		161	125	45.9	57.7	41.9	145.5
	20			46.6	85.7	40.1	172.4				46.6	57.8	41.9	146.4
	30			47.3	85.8	40.1	173.2				47.3	57.9	42.0	147.2
	40			48.0	86.0	40.2	174.1				48.0	58.0	42.1	148.1

## 80. CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOO A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOO A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.6	.3	.6	1.6		4	2	.6	.4	.6	1.6
	20			.7	.4	.6	1.6				.7	.4	.6	1.6
	30			.7	.4	.6	1.6				.7	.4	.6	1.6
	40			.7	.4	.6	1.6				.7	.4	.6	1.6
10	10	5	4	1.3	.7	1.1	3.1		7	4	1.3	.7	1.1	3.1
	20			1.3	.7	1.1	3.1				1.3	.7	1.1	3.2
	30			1.3	.7	1.1	3.2				1.3	.7	1.1	3.2
	40			1.3	.7	1.1	3.2				1.3	.7	1.1	3.2
20	10	16	8	2.6	3.0	2.2	7.8		11	8	2.6	1.5	2.3	6.3
	20			2.6	3.0	2.2	7.8				2.6	1.5	2.3	6.4
	30			2.6	3.0	2.2	7.8				2.6	1.5	2.3	6.4
	40			2.7	3.0	2.2	7.9				2.7	1.5	2.3	6.4
30	10	19	11	3.9	4.4	3.4	11.7		14	11	3.9	2.2	3.4	9.5
	20			3.9	4.4	3.4	11.7				3.9	2.2	3.4	9.5
	30			4.0	4.4	3.4	11.8				4.0	2.2	3.4	9.6
	40			4.0	4.5	3.4	11.9				4.0	2.2	3.4	9.7
40	10	23	15	5.2	5.9	4.5	15.6		18	15	5.2	2.9	4.7	12.7
	20			5.2	5.9	4.5	15.6				5.2	2.9	4.7	12.8
	30			5.3	5.9	4.5	15.7				5.3	2.9	4.7	12.9
	40			5.4	5.9	4.5	15.8				5.4	2.9	4.7	13.0
50	10	26	18	6.4	7.4	5.7	19.5		21	18	6.4	3.6	5.8	15.9
	20			6.5	7.4	5.7	19.6				6.5	3.7	5.8	16.0
	30			6.6	7.4	5.7	19.7				6.6	3.7	5.8	16.1
	40			6.7	7.4	5.7	19.8				6.7	3.7	5.8	16.2
75	10	35	27	9.7	11.1	8.5	29.3		63	27	9.7	12.3	8.4	30.4
	20			9.8	11.1	8.6	29.4				9.8	12.4	8.4	30.5
	30			9.9	11.1	8.6	29.6				9.9	12.4	8.4	30.7
	40			10.0	11.1	8.6	29.8				10.1	12.4	8.4	30.9
100	10	72	36	12.9	24.4	11.2	48.4		72	36	12.9	16.5	11.2	40.5
	20			13.1	24.4	11.2	48.7				13.1	16.5	11.2	40.7
	30			13.2	24.5	11.2	48.9				13.2	16.5	11.2	40.9
	40			13.4	24.5	11.2	49.1				13.4	16.5	11.2	41.1
125	10	90	45	16.1	30.5	13.9	60.6		81	45	16.1	20.6	14.4	51.1
	20			16.3	30.5	14.0	60.8				16.3	20.6	14.4	51.4
	30			16.5	30.6	14.0	61.1				16.5	20.6	14.5	51.7
	40			16.7	30.6	14.0	61.4				16.8	20.7	14.5	51.9
150	10	108	54	19.3	36.6	16.7	72.7		90	54	19.3	24.7	17.3	61.3
	20			19.6	36.7	16.8	73.0				19.6	24.7	17.3	61.7
	30			19.8	36.7	16.8	73.3				19.9	24.8	17.4	62.0
	40			20.1	36.8	16.8	73.6				20.1	24.8	17.4	62.3
175	10	126	63	22.6	42.7	19.5	84.8		99	63	22.6	28.8	20.2	71.6
	20			22.8	42.8	19.5	85.2				22.9	28.9	20.2	71.9
	30			23.1	42.8	19.6	85.5				23.2	28.9	20.3	72.3
	40			23.4	42.9	19.6	85.9				23.5	28.9	20.3	72.7
200	10	136	72	25.8	48.8	22.8	97.4		108	72	25.8	32.9	23.1	81.8
	20			26.1	48.9	22.9	97.8				26.1	33.0	23.1	82.2
	30			26.4	48.9	22.9	98.3				26.5	33.0	23.1	82.6
	40			26.8	49.0	22.9	98.7				26.8	33.1	23.2	83.1
250	10	154	90	32.2	61.0	28.5	121.8		126	90	32.2	41.2	29.8	103.2
	20			32.6	61.1	28.6	122.3				32.7	41.2	29.9	103.7
	30			33.1	61.2	28.6	122.8				33.1	41.3	29.9	104.3
	40			33.5	61.3	28.6	123.4				33.5	41.4	29.9	104.8
300	10	172	108	38.7	73.2	34.3	146.1		144	108	38.7	49.4	35.8	123.8
	20			39.2	73.3	34.3	146.8				39.2	49.5	35.8	124.5
	30			39.7	73.4	34.3	147.4				39.7	49.5	35.9	125.1
	40			40.2	73.5	34.4	148.1				40.2	49.6	35.9	125.8
350	10	189	125	45.1	85.4	40.0	170.5		161	125	45.1	57.6	41.8	144.5
	20			45.7	85.5	40.0	171.2				45.7	57.7	41.8	145.3
	30			46.3	85.7	40.0	172.0				46.3	57.8	41.9	146.0
	40			46.9	85.8	40.1	172.7				46.9	57.9	42.0	146.8
400	10	207	143	51.5	97.6	46.7	195.8		179	143	51.6	65.8	47.8	165.2
	20			52.2	97.8	46.7	196.7				52.3	65.9	47.8	166.0
	30			52.9	97.9	46.8	197.6				53.0	66.1	47.9	166.9
	40			53.6	98.0	46.9	198.5				53.6	66.2	48.0	167.8

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	GYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.7	.4	.6	1.7		6	3	.7	.4	.6	1.8
	20			.7	.4	.6	1.8				.7	.4	.6	1.8
	30			.7	.4	.6	1.8				.7	.4	.6	1.8
	40			.7	.4	.6	1.8				.7	.4	.6	1.8
10	10	13	5	1.4	1.7	1.3	4.4		8	5	1.4	.8	1.3	3.5
	20			1.4	1.7	1.3	4.4				1.4	.8	1.3	3.5
	30			1.5	1.7	1.3	4.4				1.5	.8	1.3	3.6
	40			1.5	1.7	1.3	4.4				1.5	.8	1.3	3.6
20	10	17	9	2.9	3.3	2.5	8.7		12	9	2.9	1.6	2.6	7.1
	20			2.9	3.3	2.5	8.8				2.9	1.6	2.6	7.1
	30			2.9	3.3	2.5	8.8				2.9	1.6	2.6	7.2
	40			3.0	3.3	2.5	8.9				3.0	1.7	2.6	7.2
30	10	21	13	4.3	5.0	3.8	13.1		16	13	4.3	2.5	3.9	10.7
	20			4.3	5.0	3.8	13.2				4.3	2.5	3.9	10.7
	30			4.4	5.0	3.8	13.2				4.4	2.5	3.9	10.8
	40			4.4	5.0	3.8	13.3				4.4	2.5	3.9	10.9
40	10	25	17	5.7	6.7	5.1	17.5		20	17	5.7	3.3	5.2	14.2
	20			5.8	6.7	5.1	17.6				5.8	3.3	5.2	14.3
	30			5.9	6.7	5.1	17.7				5.9	3.3	5.3	14.4
	40			5.9	6.7	5.1	17.8				5.9	3.3	5.3	14.5
50	10	29	21	7.2	8.3	6.4	21.9		57	21	7.2	9.3	6.3	22.7
	20			7.2	8.3	6.4	22.0				7.2	9.3	6.3	22.8
	30			7.3	8.3	6.4	22.1				7.3	9.3	6.3	22.9
	40			7.4	8.4	6.4	22.2				7.4	9.3	6.3	23.0
75	10	39	31	10.7	12.5	9.6	32.8		67	31	10.7	13.9	9.4	34.1
	20			10.9	12.5	9.6	33.0				10.9	13.9	9.4	34.2
	30			11.0	12.5	9.6	33.1				11.0	14.0	9.4	34.4
	40			11.1	12.5	9.6	33.3				11.1	14.0	9.4	34.5
100	10	82	41	14.3	27.5	12.6	54.4		77	41	14.3	18.6	13.0	45.9
	20			14.5	27.6	12.6	54.6				14.5	18.6	13.0	46.1
	30			14.7	27.6	12.6	54.8				14.7	18.6	13.0	46.3
	40			14.8	27.6	12.6	55.0				14.8	18.6	13.0	46.5
125	10	102	51	17.9	34.4	15.7	68.0		87	51	17.9	23.2	16.2	57.3
	20			18.1	34.4	15.7	68.3				18.1	23.2	16.3	57.6
	30			18.3	34.5	15.7	68.5				18.3	23.3	16.3	57.9
	40			18.5	34.5	15.7	68.8				18.5	23.3	16.3	58.1
150	10	122	61	21.5	41.3	18.8	81.6		97	61	21.5	27.8	19.5	68.8
	20			21.7	41.3	18.9	81.9				21.7	27.9	19.5	69.1
	30			22.0	41.4	18.9	82.2				22.0	27.9	19.5	69.4
	40			22.2	41.4	18.9	82.5				22.2	28.0	19.6	69.8
175	10	135	71	25.1	48.2	22.5	95.7		107	71	25.0	32.5	22.7	80.3
	20			25.3	48.2	22.5	96.1				25.3	32.5	22.8	80.6
	30			25.6	48.3	22.5	96.5				25.6	32.6	22.8	81.0
	40			25.9	48.3	22.6	96.8				25.9	32.6	22.8	81.4
200	10	145	81	28.6	55.0	25.7	109.4		117	81	28.6	37.1	26.9	92.6
	20			29.0	55.1	25.7	109.8				29.0	37.2	26.9	93.0
	30			29.3	55.2	25.7	110.2				29.3	37.2	26.9	93.5
	40			29.6	55.2	25.8	110.7				29.7	37.3	26.9	93.9
250	10	165	101	35.8	68.8	32.1	136.7		137	101	35.8	46.4	33.6	115.7
	20			36.2	68.9	32.2	137.3				36.2	46.5	33.6	116.3
	30			36.6	69.0	32.2	137.8				36.6	46.5	33.6	116.8
	40			37.1	69.1	32.2	138.3				37.1	46.6	33.7	117.4
300	10	185	121	42.9	82.6	38.5	164.1		157	121	42.9	55.7	40.3	138.9
	20			43.5	82.7	38.6	164.7				43.5	55.8	40.4	139.6
	30			44.0	82.8	38.6	165.4				44.0	55.8	40.4	140.2
	40			44.5	82.9	38.7	166.0				44.5	55.9	40.5	140.9
350	10	206	142	50.1	96.3	46.0	192.4		178	142	50.1	65.0	47.0	162.1
	20			50.7	96.4	46.0	193.2				50.7	65.1	47.1	162.8
	30			51.3	96.6	46.1	193.9				51.3	65.1	47.2	163.6
	40			51.9	96.7	46.1	194.7				51.9	65.2	47.2	164.4
400	10	226	162	57.3	110.1	52.5	219.9		198	162	57.2	74.2	57.1	188.6
	20			57.9	110.2	52.6	220.8				57.9	74.3	57.2	189.5
	30			58.6	110.4	52.7	221.6				58.6	74.5	57.3	190.3
	40			59.3	110.5	52.7	222.5				59.3	74.6	57.3	191.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.7	.4	.7	1.9	6	3	.8	.5	.7	1.9
	20			.7	.4	.7	1.9			.8	.5	.7	1.9
	30			.7	.4	.7	1.9			.8	.5	.7	2.0
	40			.7	.4	.7	1.9			.8	.5	.7	2.0
10	10	13	5	1.4	1.8	1.4	4.7	8	5	1.6	.9	1.4	3.9
	20			1.4	1.8	1.4	4.7			1.6	.9	1.4	3.9
	30			1.4	1.8	1.4	4.7			1.6	.9	1.4	3.9
	40			1.5	1.8	1.4	4.7			1.6	.9	1.4	3.9
20	10	17	9	2.9	3.7	2.8	9.4	12	9	3.1	1.8	2.8	7.8
	20			2.9	3.7	2.8	9.4			3.2	1.8	2.8	7.8
	30			2.9	3.7	2.8	9.4			3.2	1.8	2.9	7.9
	40			2.9	3.7	2.8	9.4			3.2	1.8	2.9	7.9
30	10	22	14	4.3	5.5	4.2	14.1	17	14	4.7	2.7	4.4	11.8
	20			4.3	5.5	4.2	14.1			4.8	2.7	4.4	11.9
	30			4.3	5.5	4.2	14.1			4.8	2.7	4.4	11.9
	40			4.4	5.5	4.2	14.1			4.9	2.7	4.4	12.0
40	10	26	18	5.8	7.4	5.7	18.8	21	18	6.3	3.6	5.8	15.7
	20			5.8	7.4	5.7	18.8			6.4	3.6	5.8	15.8
	30			5.8	7.4	5.7	18.9			6.4	3.6	5.8	15.9
	40			5.8	7.4	5.7	18.9			6.5	3.7	5.8	16.0
50	10	31	23	7.2	9.2	7.1	23.5	59	23	7.9	10.3	7.0	25.1
	20			7.2	9.2	7.1	23.5			7.9	10.3	7.0	25.2
	30			7.2	9.2	7.1	23.6			8.0	10.3	7.0	25.3
	40			7.3	9.2	7.1	23.6			8.1	10.3	7.0	25.4
75	10	68	34	10.8	22.8	10.4	44.1	70	34	11.8	15.4	10.4	37.6
	20			10.8	22.9	10.5	44.1			11.9	15.4	10.5	37.8
	30			10.9	22.9	10.5	44.2			12.0	15.4	10.5	37.9
	40			10.9	22.9	10.5	44.3			12.2	15.5	10.5	38.1
100	10	90	45	14.4	30.4	13.9	58.8	81	45	15.7	20.5	14.4	50.6
	20			14.4	30.5	13.9	58.8			15.9	20.6	14.4	50.8
	30			14.5	30.5	13.9	58.9			16.0	20.6	14.4	51.1
	40			14.5	30.5	14.0	59.0			16.2	20.6	14.4	51.3
125	10	112	56	18.0	38.0	17.4	73.5	92	56	19.6	25.7	18.0	63.3
	20			18.1	38.1	17.4	73.6			19.8	25.7	18.0	63.6
	30			18.1	38.1	17.4	73.7			20.1	25.7	18.0	63.8
	40			18.1	38.2	17.4	73.8			20.3	25.8	18.1	64.1
150	10	131	67	21.6	45.7	21.4	88.6	103	67	23.6	30.8	21.6	76.0
	20			21.7	45.7	21.4	88.8			23.8	30.8	21.6	76.3
	30			21.7	45.8	21.4	88.9			24.1	30.9	21.6	76.6
	40			21.8	45.8	21.4	89.0			24.3	30.9	21.7	76.9
175	10	143	79	25.2	53.3	24.9	103.4	115	79	27.5	35.9	26.0	89.4
	20			25.3	53.3	24.9	103.5			27.8	36.0	26.1	89.8
	30			25.3	53.4	25.0	103.7			28.1	36.0	26.1	90.2
	40			25.4	53.5	25.0	103.8			28.4	36.1	26.1	90.6
200	10	154	90	28.8	60.9	28.5	118.2	126	90	31.4	41.1	29.8	102.2
	20			28.9	60.9	28.5	118.3			31.8	41.1	29.8	102.7
	30			28.9	61.0	28.5	118.5			32.1	41.2	29.8	103.1
	40			29.0	61.1	28.6	118.7			32.4	41.2	29.9	103.5
250	10	176	112	36.0	76.1	35.6	147.7	148	112	39.3	51.3	37.2	127.8
	20			36.1	76.2	35.6	147.9			39.7	51.4	37.3	128.3
	30			36.2	76.3	35.7	148.1			40.1	51.5	37.3	128.9
	40			36.3	76.4	35.7	148.3			40.6	51.5	37.4	129.4
300	10	198	134	43.2	91.3	43.7	178.2	170	134	47.1	61.6	44.7	153.4
	20			43.3	91.4	43.7	178.5			47.6	61.7	44.7	154.0
	30			43.4	91.5	43.8	178.7			48.1	61.7	44.8	154.7
	40			43.5	91.6	43.8	179.0			48.7	61.8	44.8	155.3
350	10	221	157	50.4	106.5	50.9	207.9	193	157	55.0	71.8	55.4	182.2
	20			50.5	106.7	51.0	208.2			55.6	71.9	55.4	182.9
	30			50.7	106.8	51.1	208.5			56.2	72.0	55.5	183.7
	40			50.8	106.9	51.1	208.8			56.8	72.1	55.6	184.5
400	10	243	179	57.6	121.8	58.2	237.6	215	179	62.8	82.1	63.3	208.2
	20			57.8	121.9	58.3	237.9			63.5	82.2	63.4	209.1
	30			57.9	122.0	58.4	238.3			64.2	82.3	63.4	210.0
	40			58.0	122.2	58.4	238.6			64.9	82.4	63.5	210.8



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.5	.8	2.2	6	3	.9	.6	.8	2.3
	20			.9	.5	.8	2.2			.9	.6	.8	2.3
	30			.9	.5	.8	2.2			.9	.6	.8	2.3
	40			.9	.5	.8	2.2			1.0	.6	.8	2.4
10	10	14	6	1.7	2.2	1.7	5.6	9	6	1.9	1.1	1.7	4.7
	20			1.7	2.2	1.7	5.7			1.9	1.1	1.7	4.7
	30			1.7	2.2	1.7	5.7			1.9	1.1	1.7	4.7
	40			1.7	2.2	1.7	5.7			1.9	1.1	1.7	4.7
20	10	19	11	3.5	4.5	3.4	11.3	14	11	3.7	2.2	3.4	9.4
	20			3.5	4.5	3.4	11.3			3.8	2.2	3.4	9.4
	30			3.5	4.5	3.4	11.3			3.8	2.2	3.4	9.4
	40			3.5	4.5	3.4	11.4			3.8	2.2	3.4	9.5
30	10	25	17	5.2	6.7	5.1	17.0	20	17	5.6	3.3	5.1	14.0
	20			5.2	6.7	5.1	17.0			5.6	3.3	5.2	14.1
	30			5.2	6.7	5.1	17.1			5.7	3.3	5.2	14.2
	40			5.2	6.7	5.1	17.1			5.7	3.3	5.2	14.2
40	10	30	22	6.9	8.9	6.8	22.7	58	22	7.4	10.0	6.7	24.1
	20			6.9	8.9	6.8	22.7			7.5	10.0	6.7	24.2
	30			7.0	9.0	6.9	22.8			7.6	10.0	6.7	24.3
	40			7.0	9.0	6.9	22.8			7.6	10.0	6.7	24.4
50	10	36	28	8.7	11.2	8.6	28.4	64	28	9.3	12.5	8.4	30.2
	20			8.7	11.2	8.6	28.4			9.4	12.5	8.4	30.3
	30			8.7	11.2	8.6	28.5			9.5	12.5	8.4	30.4
	40			8.7	11.2	8.6	28.5			9.6	12.5	8.4	30.5
60	10	66	33	10.4	22.2	10.1	42.7	69	33	11.2	15.0	10.1	36.2
	20			10.4	22.2	10.1	42.7			11.3	15.0	10.1	36.3
	30			10.4	22.2	10.1	42.7			11.4	15.0	10.1	36.5
	40			10.4	22.3	10.1	42.8			11.5	15.0	10.1	36.6
70	10	78	39	12.1	25.9	11.7	49.8	75	39	13.0	17.5	12.2	42.6
	20			12.1	25.9	11.8	49.8			13.1	17.5	12.2	42.8
	30			12.2	25.9	11.8	49.9			13.3	17.5	12.2	42.9
	40			12.2	26.0	11.8	49.9			13.4	17.5	12.2	43.1
80	10	88	44	13.9	29.6	13.4	56.9	80	44	14.9	20.0	13.9	48.7
	20			13.9	29.6	13.4	56.9			15.0	20.0	13.9	48.9
	30			13.9	29.7	13.4	57.0			15.2	20.0	13.9	49.1
	40			13.9	29.7	13.5	57.1			15.3	20.0	13.9	49.2
90	10	98	49	15.6	33.3	15.1	64.0	85	49	16.7	22.5	15.6	54.8
	20			15.6	33.3	15.1	64.1			16.9	22.5	15.6	55.0
	30			15.6	33.4	15.1	64.1			17.1	22.5	15.7	55.2
	40			15.7	33.4	15.1	64.2			17.2	22.5	15.7	55.4
100	10	110	55	17.3	37.0	16.8	71.1	91	55	18.6	24.9	17.4	60.9
	20			17.3	37.0	16.8	71.2			18.8	25.0	17.4	61.1
	30			17.4	37.1	16.8	71.2			19.0	25.0	17.4	61.3
	40			17.4	37.1	16.8	71.3			19.1	25.0	17.4	61.6
120	10	130	66	20.8	44.4	20.6	85.8	102	66	22.3	29.9	20.8	73.1
	20			20.8	44.4	20.6	85.9			22.5	30.0	20.9	73.4
	30			20.9	44.5	20.6	86.0			22.7	30.0	20.9	73.6
	40			20.9	44.5	20.7	86.1			22.9	30.0	20.9	73.9
140	10	141	77	24.2	51.8	24.0	100.1	113	77	26.1	34.9	25.1	86.1
	20			24.3	51.8	24.1	100.2			26.3	35.0	25.2	86.4
	30			24.3	51.9	24.1	100.3			26.5	35.0	25.2	86.7
	40			24.4	51.9	24.1	100.4			26.8	35.0	25.2	87.0
160	10	151	87	27.7	59.2	27.5	114.4	123	87	29.8	39.9	28.7	98.4
	20			27.8	59.2	27.5	114.5			30.0	40.0	28.8	98.8
	30			27.8	59.3	27.5	114.6			30.3	40.0	28.8	99.1
	40			27.8	59.4	27.5	114.8			30.6	40.0	28.8	99.4
180	10	162	98	31.2	66.6	30.9	128.7	134	98	33.5	44.9	32.3	110.7
	20			31.2	66.7	30.9	128.8			33.8	45.0	32.3	111.1
	30			31.3	66.7	31.0	129.0			34.1	45.0	32.4	111.5
	40			31.3	66.8	31.0	129.1			34.4	45.1	32.4	111.9
200	10	173	109	34.6	74.0	34.3	143.0	145	109	37.2	49.9	35.9	123.0
	20			34.7	74.1	34.4	143.1			37.6	49.9	36.0	123.5
	30			34.8	74.1	34.4	143.3			37.9	50.0	36.0	123.9
	40			34.8	74.2	34.4	143.4			38.2	50.1	36.0	124.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CH LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	1.0	.6	1.0	2.6	7	4	1.1	.6	1.0	2.7
	20			1.0	.6	1.0	2.6			1.1	.6	1.0	2.7
	30			1.0	.6	1.0	2.6			1.1	.6	1.0	2.7
	40			1.0	.6	1.0	2.6			1.1	.6	1.0	2.7
10	10	15	7	2.0	2.6	1.9	6.5	10	7	2.1	1.3	2.0	5.4
	20			2.0	2.6	1.9	6.5			2.2	1.3	2.0	5.4
	30			2.0	2.6	1.9	6.5			2.2	1.3	2.0	5.4
	40			2.0	2.6	1.9	6.5			2.2	1.3	2.0	5.4
20	10	21	13	4.0	5.1	3.9	13.1	16	13	4.3	2.5	4.1	10.8
	20			4.0	5.1	3.9	13.1			4.3	2.5	4.1	10.9
	30			4.0	5.1	3.9	13.1			4.3	2.5	4.1	10.9
	40			4.0	5.1	3.9	13.1			4.4	2.5	4.1	11.0
30	10	27	19	6.0	7.7	5.9	19.6	55	19	6.4	8.6	5.8	20.8
	20			6.0	7.7	5.9	19.7			6.5	8.6	5.8	20.9
	30			6.0	7.7	6.0	19.7			6.5	8.6	5.8	21.0
	40			6.0	7.7	6.0	19.7			6.6	8.6	5.8	21.0
40	10	33	25	8.0	10.3	7.9	26.2	61	25	8.5	11.5	7.8	27.8
	20			8.0	10.3	7.9	26.2			8.6	11.5	7.8	27.9
	30			8.0	10.3	7.9	26.3			8.7	11.5	7.8	27.9
	40			8.0	10.3	7.9	26.3			8.7	11.5	7.8	28.0
50	10	40	32	10.0	12.8	9.9	32.8	68	32	10.7	14.3	9.7	34.7
	20			10.0	12.8	9.9	32.8			10.8	14.3	9.7	34.8
	30			10.0	12.9	9.9	32.8			10.8	14.4	9.7	34.9
	40			10.1	12.9	9.9	32.9			10.9	14.4	9.7	35.0
60	10	76	38	12.0	25.5	11.7	49.2	74	38	12.8	17.2	12.1	42.1
	20			12.0	25.5	11.7	49.2			12.9	17.2	12.1	42.2
	30			12.1	25.5	11.7	49.3			13.0	17.2	12.1	42.3
	40			12.1	25.6	11.7	49.3			13.1	17.2	12.1	42.5
70	10	88	44	14.0	29.8	13.6	57.4	80	44	14.9	20.1	14.1	49.1
	20			14.0	29.8	13.6	57.4			15.1	20.1	14.1	49.2
	30			14.1	29.8	13.6	57.5			15.2	20.1	14.1	49.4
	40			14.1	29.8	13.6	57.6			15.3	20.1	14.1	49.5
80	10	100	50	16.0	34.0	15.6	65.6	86	50	17.1	22.9	16.1	56.1
	20			16.1	34.0	15.6	65.7			17.2	22.9	16.1	56.3
	30			16.1	34.1	15.6	65.7			17.3	23.0	16.1	56.4
	40			16.1	34.1	15.6	65.8			17.5	23.0	16.1	56.6
90	10	114	57	18.0	38.3	17.5	73.8	93	57	19.2	25.8	18.1	63.1
	20			18.1	38.3	17.5	73.9			19.4	25.8	18.1	63.3
	30			18.1	38.3	17.5	73.9			19.5	25.8	18.1	63.5
	40			18.1	38.4	17.5	74.0			19.7	25.9	18.1	63.7
100	10	126	63	20.0	42.5	19.5	82.0	99	63	21.3	28.7	20.1	70.1
	20			20.1	42.5	19.5	82.1			21.5	28.7	20.1	70.3
	30			20.1	42.6	19.5	82.1			21.7	28.7	20.1	70.5
	40			20.1	42.6	19.5	82.2			21.8	28.7	20.2	70.8
120	10	139	75	24.0	51.0	23.9	98.9	111	75	25.6	34.4	24.9	84.9
	20			24.1	51.0	23.9	99.0			25.8	34.4	25.0	85.2
	30			24.1	51.1	23.9	99.1			26.0	34.5	25.0	85.4
	40			24.1	51.1	23.9	99.2			26.2	34.5	25.0	85.7
140	10	152	88	28.0	59.5	27.9	115.4	124	88	29.9	40.1	29.1	99.1
	20			28.1	59.6	27.9	115.5			30.1	40.2	29.1	99.4
	30			28.1	59.6	27.9	115.6			30.3	40.2	29.1	99.7
	40			28.2	59.7	27.9	115.7			30.6	40.2	29.2	100.0
160	10	164	100	32.1	68.0	31.8	131.9	136	100	34.1	45.9	33.3	113.2
	20			32.1	68.1	31.9	132.0			34.4	45.9	33.3	113.6
	30			32.1	68.1	31.9	132.1			34.7	45.9	33.3	113.9
	40			32.2	68.2	31.9	132.3			35.0	46.0	33.3	114.3
180	10	177	113	36.1	76.5	35.8	148.4	149	113	38.4	51.6	37.4	127.4
	20			36.1	76.6	35.8	148.5			38.7	51.6	37.5	127.8
	30			36.2	76.6	35.9	148.7			39.0	51.7	37.5	128.2
	40			36.2	76.7	35.9	148.8			39.3	51.7	37.5	128.6
200	10	189	125	40.1	85.0	39.8	164.9	161	125	42.7	57.3	41.6	141.6
	20			40.1	85.1	39.8	165.0			43.0	57.4	41.6	142.0
	30			40.2	85.2	39.8	165.2			43.3	57.4	41.7	142.4
	40			40.2	85.2	39.9	165.3			43.7	57.5	41.7	142.9

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	1.2	.7	1.1	3.0	7	4	1.2	.7	1.1	3.1
	20			1.2	.7	1.1	3.0			1.2	.7	1.1	3.1
	30			1.2	.7	1.1	3.0			1.2	.7	1.1	3.1
	40			1.2	.7	1.1	3.0			1.2	.7	1.1	3.1
10	10	16	8	2.3	3.0	2.2	7.6	11	8	2.4	1.5	2.3	6.2
	20			2.3	3.0	2.2	7.6			2.5	1.5	2.3	6.2
	30			2.3	3.0	2.2	7.6			2.5	1.5	2.3	6.3
	40			2.3	3.0	2.3	7.6			2.5	1.5	2.3	6.3
20	10	23	15	4.6	6.0	4.5	15.2	18	15	4.9	3.0	4.7	12.5
	20			4.6	6.0	4.5	15.2			4.9	3.0	4.7	12.6
	30			4.6	6.0	4.5	15.2			4.9	3.0	4.7	12.6
	40			4.6	6.0	4.5	15.2			5.0	3.0	4.7	12.7
30	10	31	23	6.9	9.0	6.9	22.8	59	23	7.3	10.1	6.7	24.2
	20			6.9	9.1	6.9	22.9			7.4	10.1	6.7	24.2
	30			6.9	9.1	6.9	22.9			7.4	10.1	6.7	24.3
	40			7.0	9.1	6.9	22.9			7.5	10.1	6.8	24.4
40	10	38	30	9.2	12.1	9.2	30.5	66	30	9.8	13.5	9.0	32.2
	20			9.3	12.1	9.2	30.5			9.8	13.5	9.0	32.3
	30			9.3	12.1	9.2	30.5			9.9	13.5	9.0	32.4
	40			9.3	12.1	9.2	30.6			10.0	13.5	9.0	32.5
50	10	74	37	11.6	25.0	11.2	47.8	73	37	12.2	16.8	11.6	40.7
	20			11.6	25.0	11.2	47.8			12.3	16.9	11.6	40.8
	30			11.6	25.0	11.2	47.8			12.4	16.9	11.6	40.9
	40			11.6	25.0	11.3	47.9			12.5	16.9	11.7	41.0
60	10	90	45	13.9	30.0	13.5	57.3	81	45	14.6	20.2	14.0	48.8
	20			13.9	30.0	13.5	57.4			14.7	20.2	14.0	48.9
	30			13.9	30.0	13.5	57.4			14.8	20.2	14.0	49.1
	40			13.9	30.0	13.5	57.5			14.9	20.3	14.0	49.2
70	10	104	52	16.2	35.0	15.7	66.9	88	52	17.1	23.6	16.3	56.9
	20			16.2	35.0	15.7	66.9			17.2	23.6	16.3	57.1
	30			16.2	35.0	15.7	67.0			17.3	23.6	16.3	57.2
	40			16.2	35.0	15.8	67.0			17.4	23.6	16.3	57.4
80	10	118	59	18.5	40.0	18.0	76.4	95	59	19.5	26.9	18.6	65.1
	20			18.5	40.0	18.0	76.5			19.7	27.0	18.6	65.3
	30			18.5	40.0	18.0	76.5			19.8	27.0	18.6	65.4
	40			18.6	40.0	18.0	76.6			19.9	27.0	18.6	65.6
90	10	131	67	20.8	45.0	20.7	86.4	103	67	22.0	30.3	20.9	73.2
	20			20.8	45.0	20.7	86.5			22.1	30.3	21.0	73.4
	30			20.8	45.0	20.7	86.6			22.3	30.4	21.0	73.6
	40			20.9	45.1	20.7	86.7			22.4	30.4	21.0	73.8
100	10	138	74	23.1	49.9	23.0	96.1	110	74	24.4	33.7	24.1	82.1
	20			23.1	50.0	23.0	96.1			24.6	33.7	24.1	82.4
	30			23.2	50.0	23.0	96.2			24.7	33.7	24.1	82.6
	40			23.2	50.1	23.0	96.3			24.9	33.8	24.1	82.8
120	10	153	89	27.7	59.9	27.6	115.3	125	89	29.3	40.4	28.9	98.6
	20			27.8	60.0	27.6	115.4			29.5	40.4	28.9	98.8
	30			27.8	60.0	27.6	115.5			29.7	40.5	28.9	99.1
	40			27.8	60.1	27.6	115.5			29.9	40.5	28.9	99.4
140	10	167	103	32.4	69.9	32.2	134.5	139	103	34.2	47.1	33.7	115.0
	20			32.4	70.0	32.2	134.6			34.4	47.2	33.7	115.3
	30			32.4	70.0	32.2	134.7			34.6	47.2	33.7	115.6
	40			32.5	70.1	32.3	134.8			34.9	47.3	33.8	115.9
160	10	182	118	37.0	79.9	36.8	153.7	154	118	39.1	53.9	38.5	131.5
	20			37.0	80.0	36.8	153.8			39.3	53.9	38.6	131.8
	30			37.1	80.0	36.8	153.9			39.6	54.0	38.6	132.2
	40			37.1	80.1	36.9	154.1			39.9	54.0	38.6	132.5
180	10	197	133	41.6	89.9	42.3	173.8	169	133	43.9	60.6	43.3	147.9
	20			41.6	90.0	42.4	174.0			44.2	60.7	43.4	148.3
	30			41.7	90.0	42.4	174.1			44.5	60.7	43.4	148.7
	40			41.7	90.1	42.4	174.3			44.8	60.8	43.4	149.1
200	10	212	148	46.2	99.9	47.0	193.1	184	148	48.8	67.4	51.3	167.5
	20			46.3	100.0	47.1	193.3			49.2	67.4	51.3	167.9
	30			46.3	100.0	47.1	193.5			49.5	67.5	51.4	168.3
	40			46.4	100.1	47.1	193.6			49.8	67.5	51.4	168.8

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.3	1.7	1.3	4.3		8	5	1.4	.8	1.3	3.5
	20			1.3	1.7	1.3	4.3				1.4	.8	1.3	3.5
	30			1.3	1.7	1.3	4.3				1.4	.8	1.3	3.5
	40			1.3	1.7	1.3	4.3				1.4	.8	1.3	3.5
10	10	17	9	2.6	3.4	2.6	8.6		12	9	2.7	1.7	2.6	7.0
	20			2.6	3.4	2.6	8.6				2.8	1.7	2.6	7.0
	30			2.6	3.4	2.6	8.6				2.8	1.7	2.6	7.0
	40			2.6	3.4	2.6	8.6				2.8	1.7	2.6	7.1
20	10	25	17	5.2	6.8	5.2	17.2		20	17	5.5	3.4	5.2	14.0
	20			5.2	6.8	5.2	17.2				5.5	3.4	5.2	14.1
	30			5.2	6.8	5.2	17.2				5.5	3.4	5.2	14.1
	40			5.2	6.8	5.2	17.2				5.6	3.4	5.2	14.1
30	10	33	25	7.8	10.2	7.7	25.8		61	25	8.2	11.4	7.6	27.2
	20			7.8	10.2	7.8	25.8				8.3	11.4	7.6	27.3
	30			7.8	10.3	7.8	25.8				8.3	11.5	7.6	27.4
	40			7.8	10.3	7.8	25.9				8.4	11.5	7.6	27.4
40	10	68	34	10.4	22.6	10.1	43.2		70	34	10.9	15.3	10.1	36.3
	20			10.4	22.6	92.1	43.2				11.0	15.3	10.1	36.4
	30			10.4	22.7	10.1	43.2				11.1	15.3	10.1	36.5
	40			10.4	22.7	10.2	43.3				11.1	15.3	10.2	36.6
50	10	84	42	13.0	28.3	12.7	54.0		78	42	13.7	19.1	13.1	45.9
	20			13.0	28.3	12.7	54.0				13.8	19.1	13.1	46.0
	30			13.0	28.3	12.7	54.0				13.8	19.1	13.1	46.1
	40			13.1	28.3	12.7	54.1				13.9	19.1	13.1	46.2
60	10	100	50	15.6	33.9	15.2	64.8		86	50	16.4	22.9	15.7	55.0
	20			15.6	34.0	15.2	64.8				16.5	22.9	15.8	55.2
	30			15.7	34.0	15.2	64.9				16.6	22.9	15.8	55.3
	40			15.7	34.0	15.2	64.9				16.7	22.9	15.8	55.4
70	10	118	59	18.2	39.6	17.7	75.6		95	59	19.1	26.7	18.4	64.2
	20			18.2	39.6	17.7	75.6				19.3	26.7	18.4	64.4
	30			18.3	39.6	17.8	75.7				19.4	26.7	18.4	64.5
	40			18.3	39.7	17.8	75.7				19.5	26.8	18.4	64.7
80	10	131	67	20.8	45.2	20.7	86.8		103	67	21.9	30.5	21.0	73.4
	20			20.9	45.3	20.8	86.9				22.0	30.5	21.0	73.5
	30			20.9	45.3	20.8	87.0				22.1	30.6	21.0	73.7
	40			20.9	45.3	20.8	87.0				22.3	30.6	21.0	73.9
90	10	139	75	23.4	50.9	23.3	97.7		111	75	24.6	34.3	24.4	83.4
	20			23.5	50.9	23.4	97.8				24.8	34.3	24.5	83.6
	30			23.5	51.0	23.4	97.8				24.9	34.4	24.5	83.8
	40			23.5	51.0	23.4	97.9				25.1	34.4	24.5	83.9
100	10	148	84	26.0	56.6	25.9	108.5		120	84	27.3	38.1	27.2	92.6
	20			26.1	56.6	26.0	108.6				27.5	38.2	27.2	92.8
	30			26.1	56.6	26.0	108.7				27.7	38.2	27.2	93.1
	40			26.1	56.7	26.0	108.8				27.8	38.2	27.2	93.3
120	10	164	100	31.2	67.9	31.1	130.2		136	100	32.8	45.8	32.6	111.2
	20			31.3	67.9	31.1	130.3				33.0	45.8	32.6	111.4
	30			31.3	68.0	31.2	130.4				33.2	45.8	32.6	111.7
	40			31.3	68.0	31.2	130.5				33.4	45.9	32.6	111.9
140	10	181	117	36.5	79.2	36.3	151.9		153	117	38.3	53.4	38.0	129.7
	20			36.5	79.2	36.3	152.1				38.5	53.4	38.1	130.0
	30			36.5	79.3	36.4	152.2				38.7	53.5	38.1	130.3
	40			36.6	79.3	36.4	152.3				39.0	53.5	38.1	130.6
160	10	198	134	41.7	90.5	42.4	174.6		170	134	43.7	61.0	43.5	148.2
	20			41.7	90.6	42.5	174.7				44.0	61.1	43.5	148.6
	30			41.7	90.6	42.5	174.9				44.3	61.1	43.5	148.9
	40			41.8	90.7	42.5	175.0				44.5	61.2	43.6	149.3
180	10	214	150	46.9	101.8	47.8	196.4		186	150	49.2	68.6	52.1	170.0
	20			46.9	101.9	47.8	196.6				49.5	68.7	52.2	170.4
	30			47.0	101.9	47.8	196.7				49.8	68.8	52.2	170.8
	40			47.0	102.0	47.8	196.9				50.1	68.8	52.2	171.2
200	10	231	167	52.1	113.1	53.1	218.3		203	167	54.7	76.3	57.9	188.9
	20			52.1	113.2	53.1	218.4				55.0	76.3	58.0	189.3
	30			52.2	113.3	53.1	218.6				55.3	76.4	58.0	189.7
	40			52.2	113.4	53.2	218.8				55.7	76.4	58.0	190.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.4	1.8	1.4	4.6	8	5	1.4	.9	1.4	3.7
	20			1.4	1.8	1.4	4.6			1.4	.9	1.4	3.7
	30			1.4	1.8	1.4	4.6			1.4	.9	1.4	3.7
	40			1.4	1.8	1.4	4.7			1.4	.9	1.4	3.7
10	10	17	9	2.8	3.7	2.8	9.3	12	9	2.8	1.8	2.8	7.5
	20			2.9	3.7	2.8	9.3			2.9	1.8	2.8	7.5
	30			2.9	3.7	2.8	9.3			2.9	1.8	2.8	7.5
	40			2.9	3.7	2.8	9.3			2.9	1.8	2.8	7.5
20	10	26	18	5.7	7.3	5.6	18.7	21	18	5.7	3.6	5.7	15.0
	20			5.7	7.3	5.7	18.7			5.7	3.6	5.7	15.0
	30			5.7	7.3	5.7	18.7			5.7	3.6	5.7	15.0
	40			5.7	7.3	5.7	18.7			5.7	3.6	5.7	15.0
30	10	35	27	8.5	11.0	8.5	28.0	63	27	8.5	12.3	8.3	29.1
	20			8.6	11.0	8.5	28.0			8.6	12.3	8.3	29.1
	30			8.6	11.0	8.5	28.0			8.6	12.3	8.3	29.2
	40			8.6	11.0	8.5	28.1			8.6	12.3	8.3	29.2
40	10	72	36	11.4	24.2	11.1	46.7	72	36	11.4	16.3	11.1	38.8
	20			11.4	24.3	11.1	46.8			11.4	16.4	11.1	38.9
	30			11.4	24.3	11.1	46.8			11.4	16.4	11.1	38.9
	40			11.4	24.3	11.1	46.8			11.4	16.4	11.1	38.9
50	10	90	45	14.2	30.3	13.9	58.4	81	45	14.2	20.4	14.3	49.0
	20			14.3	30.3	13.9	58.5			14.3	20.4	14.4	49.1
	30			14.3	30.3	13.9	58.5			14.3	20.5	14.4	49.1
	40			14.3	30.4	13.9	58.5			14.3	20.5	14.4	49.1
60	10	108	54	17.1	36.4	16.7	70.1	90	54	17.1	24.5	17.2	58.8
	20			17.1	36.4	16.7	70.1			17.1	24.5	17.2	58.9
	30			17.1	36.4	16.7	70.2			17.1	24.5	17.2	58.9
	40			17.1	36.4	16.7	70.2			17.1	24.6	17.2	59.0
70	10	126	63	19.9	42.4	19.4	81.8	99	63	19.9	28.6	20.1	68.6
	20			20.0	42.4	19.4	81.8			20.0	28.6	20.1	68.7
	30			20.0	42.5	19.4	81.9			20.0	28.6	20.1	68.7
	40			20.0	42.5	19.5	81.9			20.0	28.7	20.1	68.8
80	10	136	72	22.8	48.5	22.7	94.0	108	72	22.8	32.7	23.0	78.4
	20			22.8	48.5	22.7	94.0			22.8	32.7	23.0	78.5
	30			22.8	48.5	22.7	94.1			22.8	32.7	23.0	78.5
	40			22.9	48.6	22.7	94.1			22.9	32.8	23.0	78.6
90	10	145	81	25.6	54.5	25.5	105.7	117	81	25.6	36.8	26.7	89.1
	20			25.7	54.6	25.5	105.8			25.7	36.8	26.7	89.1
	30			25.7	54.6	25.6	105.8			25.7	36.8	26.7	89.2
	40			25.7	54.6	25.6	105.9			25.7	36.8	26.7	89.3
100	10	154	90	28.5	60.6	28.4	117.4	126	90	28.5	40.8	29.6	99.0
	20			28.5	60.6	28.4	117.5			28.5	40.9	29.6	99.0
	30			28.5	60.7	28.4	117.6			28.5	40.9	29.7	99.1
	40			28.6	60.7	28.4	117.7			28.6	40.9	29.7	99.2
120	10	172	108	34.2	72.7	34.0	140.9	144	108	34.2	49.0	35.6	118.8
	20			34.2	72.8	34.1	141.0			34.2	49.1	35.6	118.9
	30			34.2	72.8	34.1	141.1			34.3	49.1	35.6	118.9
	40			34.3	72.8	34.1	141.2			34.3	49.1	35.6	119.0
140	10	189	125	39.9	84.8	39.7	164.4	161	125	39.9	57.2	41.5	138.6
	20			39.9	84.9	39.7	164.5			39.9	57.2	41.5	138.7
	30			40.0	84.9	39.8	164.6			40.0	57.3	41.6	138.8
	40			40.0	85.0	39.8	164.8			40.0	57.3	41.6	138.9
160	10	207	143	45.6	96.9	46.4	188.9	179	143	45.6	65.4	47.4	158.4
	20			45.6	97.0	46.4	189.0			45.6	65.4	47.5	158.5
	30			45.7	97.1	46.4	189.2			45.7	65.5	47.5	158.6
	40			45.7	97.1	46.5	189.3			45.7	65.5	47.5	158.8
180	10	225	161	51.3	109.1	52.2	212.5	197	161	51.3	73.5	56.7	181.5
	20			51.3	109.1	52.2	212.7			51.3	73.6	56.7	181.7
	30			51.4	109.2	52.2	212.8			51.4	73.6	56.8	181.8
	40			51.4	109.3	52.3	213.0			51.4	73.7	56.8	182.0
200	10	243	179	57.0	121.2	58.0	236.1	215	179	57.0	81.7	63.0	201.7
	20			57.0	121.3	58.0	236.3			57.0	81.8	63.1	201.8
	30			57.1	121.3	58.0	236.4			57.1	81.8	63.1	202.0
	40			57.1	121.4	58.1	236.6			57.2	81.9	63.1	202.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.6	2.1	1.6	5.3	9	6	1.6	1.0	1.6	4.2
	20			1.6	2.1	1.6	5.3			1.6	1.1	1.6	4.2
	30			1.6	2.1	1.6	5.3			1.6	1.1	1.6	4.2
	40			1.6	2.1	1.6	5.3			1.6	1.1	1.6	4.2
10	10	19	11	3.2	4.3	3.2	10.6	14	11	3.2	2.1	3.2	8.5
	20			3.2	4.3	3.2	10.6			3.2	2.1	3.2	8.5
	30			3.2	4.3	3.2	10.6			3.2	2.1	3.2	8.5
	40			3.2	4.3	3.2	10.6			3.2	2.1	3.2	8.5
15	10	24	16	4.8	6.4	4.7	15.9	19	16	4.8	3.1	4.8	12.7
	20			4.8	6.4	4.7	15.9			4.8	3.2	4.8	12.8
	30			4.8	6.4	4.7	15.9			4.8	3.2	4.8	12.8
	40			4.8	6.4	4.7	16.0			4.8	3.2	4.8	12.8
20	10	29	21	6.4	8.5	6.4	21.3	57	21	6.4	9.5	6.2	22.2
	20			6.4	8.5	6.4	21.3			6.4	9.5	6.2	22.2
	30			6.4	8.5	6.4	21.3			6.4	9.5	6.3	22.2
	40			6.4	8.5	6.4	21.3			6.4	9.5	6.3	22.2
25	10	35	27	8.0	10.6	8.0	26.6	63	27	8.0	11.9	7.8	27.7
	20			8.0	10.7	8.0	26.6			8.0	11.9	7.8	27.7
	30			8.0	10.7	8.0	26.7			8.0	11.9	7.8	27.8
	40			8.0	10.7	8.0	26.7			8.0	11.9	7.8	27.8
30	10	40	32	9.6	12.8	9.6	31.9	68	32	9.6	14.3	9.4	33.3
	20			9.6	12.8	9.6	32.0			9.6	14.3	9.4	33.3
	30			9.6	12.8	9.6	32.0			9.6	14.3	9.4	33.3
	40			9.6	12.8	9.6	32.0			9.6	14.3	9.4	33.3
35	10	74	37	11.2	24.7	10.9	46.9	73	37	11.2	16.7	11.3	39.2
	20			11.2	24.7	10.9	46.9			11.2	16.7	11.3	39.2
	30			11.2	24.7	10.9	46.9			11.2	16.7	11.3	39.3
	40			11.2	24.8	10.9	46.9			11.2	16.7	11.3	39.3
40	10	84	42	12.8	28.2	12.5	53.6	78	42	12.8	19.0	12.9	44.8
	20			12.8	28.3	12.5	53.6			12.8	19.1	13.0	44.8
	30			12.8	28.3	12.5	53.6			12.8	19.1	13.0	44.9
	40			12.9	28.3	12.5	53.7			12.8	19.1	13.0	44.9
45	10	94	47	14.4	31.8	14.1	60.3	83	47	14.4	21.4	14.6	50.4
	20			14.4	31.8	14.1	60.3			14.4	21.4	14.6	50.4
	30			14.4	31.8	14.1	60.3			14.4	21.5	14.6	50.5
	40			14.5	31.8	14.1	60.4			14.5	21.5	14.6	50.5
50	10	106	53	16.0	35.3	15.6	66.9	89	53	16.0	23.8	16.2	56.0
	20			16.0	35.3	15.6	67.0			16.0	23.8	16.2	56.0
	30			16.0	35.3	15.6	67.0			16.0	23.8	16.2	56.1
	40			16.1	35.4	15.6	67.1			16.1	23.9	16.2	56.1
55	10	116	58	17.6	38.8	17.2	73.6	94	58	17.6	26.2	17.8	61.6
	20			17.6	38.9	17.2	73.7			17.6	26.2	17.8	61.6
	30			17.7	38.9	17.2	73.7			17.7	26.2	17.8	61.7
	40			17.7	38.9	17.2	73.8			17.7	26.2	17.8	61.7
60	10	126	63	19.2	42.4	18.7	80.3	99	63	19.2	28.6	19.4	67.2
	20			19.2	42.4	18.7	80.4			19.2	28.6	19.4	67.3
	30			19.3	42.4	18.8	80.4			19.3	28.6	19.4	67.3
	40			19.3	42.4	18.8	80.5			19.3	28.6	19.5	67.3
70	10	137	73	22.4	49.4	22.4	94.2	109	73	22.4	33.3	23.5	79.2
	20			22.5	49.5	22.4	94.3			22.4	33.3	23.5	79.3
	30			22.5	49.5	22.4	94.4			22.5	33.4	23.5	79.3
	40			22.5	49.5	22.4	94.4			22.5	33.4	23.5	79.4
80	10	148	84	25.6	56.5	25.6	107.7	120	84	25.6	38.1	26.8	90.5
	20			25.7	56.5	25.6	107.8			25.7	38.1	26.8	90.6
	30			25.7	56.6	25.6	107.8			25.7	38.1	26.8	90.7
	40			25.7	56.6	25.6	107.9			25.7	38.2	26.9	90.7
90	10	158	94	28.8	63.5	28.8	121.2	130	94	28.8	42.8	30.2	101.8
	20			28.9	63.6	28.8	121.2			28.9	42.9	30.2	101.9
	30			28.9	63.6	28.8	121.3			28.9	42.9	30.2	102.0
	40			28.9	63.7	28.8	121.4			28.9	42.9	30.2	102.1
100	10	169	105	32.0	70.6	32.0	134.6	141	105	32.0	47.6	33.5	113.2
	20			32.1	70.6	32.0	134.7			32.1	47.6	33.5	113.2
	30			32.1	70.7	32.0	134.8			32.1	47.7	33.6	113.3
	40			32.1	70.7	32.0	134.9			32.1	47.7	33.6	113.4

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.7	2.3	1.7	5.8	9	6	1.7	1.1	1.7	4.6
	20			1.7	2.3	1.7	5.8			1.7	1.1	1.7	4.6
	30			1.7	2.3	1.7	5.8			1.7	1.1	1.7	4.6
	40			1.8	2.3	1.7	5.8			1.8	1.1	1.7	4.6
10	10	20	12	3.5	4.6	3.4	11.6	15	12	3.5	2.3	3.5	9.3
	20			3.5	4.6	3.4	11.6			3.5	2.3	3.5	9.3
	30			3.5	4.7	3.4	11.6			3.5	2.3	3.5	9.3
	40			3.5	4.7	3.4	11.6			3.5	2.3	3.5	9.3
15	10	26	18	5.2	7.0	5.2	17.4	21	18	5.2	3.4	5.2	13.9
	20			5.2	7.0	5.2	17.4			5.2	3.4	5.2	13.9
	30			5.2	7.0	5.2	17.4			5.2	3.4	5.2	13.9
	40			5.3	7.0	5.2	17.4			5.3	3.4	5.2	13.9
20	10	31	23	7.0	9.3	6.9	23.2	59	23	7.0	10.4	6.8	24.2
	20			7.0	9.3	6.9	23.2			7.0	10.4	6.8	24.2
	30			7.0	9.3	6.9	23.2			7.0	10.4	6.8	24.2
	40			7.0	9.3	7.0	23.3			7.0	10.4	6.8	24.2
25	10	37	29	8.7	11.6	8.7	29.0	65	29	8.7	13.0	8.5	30.2
	20			8.7	11.6	8.7	29.0			8.7	13.0	8.5	30.2
	30			8.7	11.6	8.7	29.1			8.7	13.0	8.5	30.3
	40			8.8	11.6	8.7	29.1			8.8	13.0	8.5	30.3
30	10	70	35	10.5	23.1	10.2	43.8	71	35	10.5	15.6	10.2	36.3
	20			10.5	23.1	10.2	43.8			10.5	15.6	10.2	36.3
	30			10.5	23.1	10.2	43.8			10.5	15.6	10.2	36.3
	40			10.5	23.1	10.2	43.9			10.5	15.6	10.2	36.3
35	10	80	40	12.2	26.9	11.9	51.1	76	40	12.2	18.2	12.4	42.7
	20			12.2	27.0	11.9	51.1			12.2	18.2	12.4	42.8
	30			12.2	27.0	11.9	51.2			12.2	18.2	12.4	42.8
	40			12.3	27.0	11.9	51.2			12.3	18.2	12.4	42.8
40	10	92	46	14.0	30.8	13.6	58.4	82	46	14.0	20.8	14.1	48.9
	20			14.0	30.8	13.6	58.4			14.0	20.8	14.1	48.9
	30			14.0	30.8	13.6	58.5			14.0	20.8	14.1	48.9
	40			14.0	30.8	13.6	58.5			14.0	20.8	14.1	48.9
45	10	104	52	15.7	34.6	15.3	65.7	88	52	15.7	23.4	15.9	55.0
	20			15.7	34.7	15.3	65.7			15.7	23.4	15.9	55.0
	30			15.7	34.7	15.3	65.8			15.7	23.4	15.9	55.0
	40			15.8	34.7	15.3	65.8			15.8	23.4	15.9	55.1
50	10	114	57	17.5	38.5	17.0	73.0	93	57	17.5	26.0	17.7	61.1
	20			17.5	38.5	17.0	73.0			17.5	26.0	17.7	61.1
	30			17.5	38.5	17.0	73.1			17.5	26.0	17.7	61.1
	40			17.5	38.6	17.0	73.1			17.5	26.0	17.7	61.2
55	10	126	63	19.2	42.3	18.7	80.3	99	63	19.2	28.6	19.4	67.2
	20			19.2	42.4	18.7	80.3			19.2	28.6	19.4	67.2
	30			19.2	42.4	18.7	80.4			19.2	28.6	19.4	67.3
	40			19.3	42.4	18.8	80.4			19.3	28.6	19.4	67.3
60	10	133	69	21.0	46.2	20.9	88.1	105	69	21.0	31.1	21.2	73.3
	20			21.0	46.2	20.9	88.1			21.0	31.2	21.2	73.3
	30			21.0	46.2	20.9	88.2			21.0	31.2	21.2	73.4
	40			21.0	46.3	21.0	88.2			21.0	31.2	21.2	73.4
70	10	144	80	24.4	53.9	24.4	102.8	116	80	24.4	36.3	25.6	86.4
	20			24.5	53.9	24.4	102.8			24.5	36.4	25.6	86.4
	30			24.5	54.0	24.4	102.9			24.5	36.4	25.6	86.5
	40			24.5	54.0	24.4	102.9			24.5	36.4	25.6	86.5
80	10	155	91	27.9	61.6	27.9	117.4	127	91	27.9	41.5	29.2	98.7
	20			28.0	61.6	27.9	117.5			28.0	41.6	29.3	98.8
	30			28.0	61.7	27.9	117.6			28.0	41.6	29.3	98.8
	40			28.0	61.7	27.9	117.6			28.0	41.6	29.3	98.9
90	10	167	103	31.4	69.3	31.4	132.1	139	103	31.4	46.7	32.9	111.0
	20			31.5	69.3	31.4	132.2			31.5	46.8	32.9	111.1
	30			31.5	69.4	31.4	132.3			31.5	46.8	32.9	111.2
	40			31.5	69.4	31.4	132.3			31.5	46.8	33.0	111.3
100	10	178	114	34.9	77.0	34.9	146.8	150	114	34.9	51.9	36.6	123.4
	20			35.0	77.0	34.9	146.9			34.9	51.9	36.6	123.5
	30			35.0	77.1	34.9	147.0			35.0	52.0	36.6	123.6
	40			35.0	77.1	34.9	147.0			35.0	52.0	36.6	123.7

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD 8	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD 8	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.9	2.6	1.9	6.3	10	7	1.9	1.3	1.9	5.1
	20			1.9	2.6	1.9	6.3			1.9	1.3	1.9	5.1
	30			1.9	2.6	1.9	6.3			1.9	1.3	1.9	5.1
	40			1.9	2.6	1.9	6.3			1.9	1.3	1.9	5.1
10	10	21	13	3.8	5.1	3.7	12.7	16	13	3.8	2.5	3.9	10.2
	20			3.8	5.1	3.7	12.7			3.8	2.5	3.9	10.2
	30			3.8	5.1	3.8	12.7			3.8	2.5	3.9	10.2
	40			3.8	5.1	3.8	12.7			3.8	2.5	3.9	10.2
15	10	27	19	5.7	7.7	5.7	19.0	55	19	5.7	8.6	5.6	19.8
	20			5.7	7.7	5.7	19.1			5.7	8.6	5.6	19.8
	30			5.7	7.7	5.7	19.1			5.7	8.6	5.6	19.9
	40			5.7	7.7	5.7	19.1			5.7	8.6	5.6	19.9
20	10	33	25	7.6	10.2	7.6	25.4	61	25	7.6	11.4	7.4	26.4
	20			7.6	10.2	7.6	25.4			7.6	11.4	7.4	26.5
	30			7.6	10.2	7.6	25.4			7.6	11.4	7.4	26.5
	40			7.6	10.2	7.6	25.4			7.6	11.4	7.4	26.5
25	10	40	32	9.5	12.8	9.5	31.7	68	32	9.5	14.3	9.3	33.1
	20			9.5	12.8	9.5	31.8			9.5	14.3	9.3	33.1
	30			9.5	12.8	9.5	31.8			9.5	14.3	9.3	33.1
	40			9.5	12.8	9.5	31.8			9.5	14.3	9.3	33.1
30	10	76	38	11.4	25.4	11.1	47.9	74	38	11.4	17.1	11.5	40.1
	20			11.4	25.4	11.1	48.0			11.4	17.1	11.6	40.1
	30			11.4	25.4	11.1	48.0			11.4	17.1	11.6	40.1
	40			11.4	25.4	11.1	48.0			11.4	17.2	11.6	40.2
35	10	88	44	13.3	29.6	13.0	55.9	80	44	13.3	20.0	13.5	46.8
	20			13.3	29.6	13.0	56.0			13.3	20.0	13.5	46.8
	30			13.3	29.7	13.0	56.0			13.3	20.0	13.5	46.8
	40			13.3	29.7	13.0	56.0			13.3	20.0	13.5	46.8
40	10	100	50	15.2	33.9	14.8	63.9	86	50	15.2	22.8	15.4	53.4
	20			15.2	33.9	14.9	64.0			15.2	22.8	15.4	53.5
	30			15.2	33.9	14.9	64.0			15.2	22.9	15.4	53.5
	40			15.3	33.9	14.9	64.0			15.2	22.9	15.4	53.5
45	10	114	57	17.1	38.1	16.7	71.9	93	57	17.1	25.7	17.3	60.1
	20			17.1	38.1	16.7	72.0			17.1	25.7	17.3	60.2
	30			17.1	38.1	16.7	72.0			17.1	25.7	17.3	60.2
	40			17.2	38.1	16.7	72.0			17.2	25.7	17.3	60.2
50	10	126	63	19.0	42.3	18.6	79.9	99	63	19.0	28.5	19.2	66.8
	20			19.0	42.3	18.6	79.9			19.0	28.6	19.3	66.8
	30			19.1	42.4	18.6	80.0			19.0	28.6	19.3	66.9
	40			19.1	42.4	18.6	80.0			19.1	28.6	19.3	66.9
55	10	133	69	20.9	46.6	20.9	88.4	105	69	20.9	31.4	21.2	73.5
	20			20.9	46.6	20.9	88.4			20.9	31.4	21.2	73.5
	30			21.0	46.6	20.9	88.5			21.0	31.4	21.2	73.6
	40			21.0	46.6	20.9	88.5			21.0	31.4	21.2	73.6
60	10	139	75	22.8	50.8	22.8	96.4	111	75	22.8	34.2	23.9	81.0
	20			22.8	50.8	22.8	96.5			22.8	34.3	23.9	81.0
	30			22.9	50.8	22.8	96.5			22.9	34.3	24.0	81.1
	40			22.9	50.9	22.8	96.6			22.9	34.3	24.0	81.1
70	10	152	88	26.6	59.3	26.6	112.5	124	88	26.6	40.0	27.9	94.5
	20			26.7	59.3	26.6	112.6			26.6	40.0	27.9	94.6
	30			26.7	59.3	26.6	112.6			26.7	40.0	27.9	94.6
	40			26.7	59.3	26.6	112.7			26.7	40.0	28.0	94.7
80	10	164	100	30.4	67.7	30.4	128.6	136	100	30.4	45.7	31.9	108.0
	20			30.5	67.8	30.4	128.6			30.4	45.7	31.9	108.1
	30			30.5	67.8	30.4	128.7			30.5	45.7	31.9	108.1
	40			30.5	67.8	30.5	128.8			30.5	45.7	32.0	108.2
90	10	177	113	34.2	76.2	34.2	144.6	149	113	34.2	51.4	35.9	121.5
	20			34.3	76.2	34.2	144.7			34.3	51.4	35.9	121.6
	30			34.3	76.3	34.2	144.8			34.3	51.4	36.0	121.7
	40			34.3	76.3	34.3	144.9			34.3	51.5	36.0	121.7
100	10	189	125	38.1	84.6	38.0	160.7	161	125	38.0	57.1	39.9	135.0
	20			38.1	84.7	38.0	160.8			38.1	57.1	39.9	135.1
	30			38.1	84.7	38.1	160.9			38.1	57.1	40.0	135.2
	40			38.1	84.8	38.1	161.0			38.1	57.2	40.0	135.3



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	2.0	2.6	1.9	6.5		10	7	2.0	1.3	2.0	5.2
	20			2.0	2.6	1.9	6.5				2.0	1.3	2.0	5.2
	30			2.0	2.6	1.9	6.5				2.0	1.3	2.0	5.2
	40			2.0	2.6	1.9	6.5				2.0	1.3	2.0	5.2
10	10	21	13	4.0	5.1	3.9	13.0		16	13	4.0	2.5	4.0	10.5
	20			4.0	5.1	3.9	13.0				4.0	2.5	4.0	10.5
	30			4.0	5.1	3.9	13.0				4.0	2.5	4.0	10.5
	40			4.0	5.1	3.9	13.0				4.0	2.5	4.0	10.5
15	10	27	19	6.0	7.7	5.9	19.5		55	19	6.0	8.6	5.8	20.3
	20			6.0	7.7	5.9	19.6				6.0	8.6	5.8	20.4
	30			6.0	7.7	5.9	19.6				6.0	8.6	5.8	20.4
	40			6.0	7.7	5.9	19.6				6.0	8.6	5.8	20.4
20	10	33	25	8.0	10.2	7.9	26.1		61	25	7.9	11.4	7.8	27.1
	20			8.0	10.2	7.9	26.1				8.0	11.4	7.8	27.1
	30			8.0	10.2	7.9	26.1				8.0	11.4	7.8	27.2
	40			8.0	10.2	7.9	26.1				8.0	11.4	7.8	27.2
25	10	40	32	9.9	12.8	9.9	32.6		68	32	9.9	14.3	9.7	33.9
	20			9.9	12.8	9.9	32.6				9.9	14.3	9.7	33.9
	30			10.0	12.8	9.9	32.6				9.9	14.3	9.7	34.0
	40			10.0	12.8	9.9	32.6				10.0	14.3	9.7	34.0
30	10	76	38	11.9	25.4	11.6	49.0		74	38	11.9	17.1	12.0	41.1
	20			11.9	25.4	11.7	49.0				11.9	17.1	12.0	41.1
	30			11.9	25.4	11.7	49.0				11.9	17.1	12.0	41.1
	40			11.9	25.4	11.7	49.0				11.9	17.2	12.0	41.2
35	10	88	44	13.9	29.6	13.6	57.1		80	44	13.9	20.0	14.0	47.9
	20			13.9	29.7	13.6	57.2				13.9	20.0	14.0	48.0
	30			13.9	29.7	13.6	57.2				13.9	20.0	14.1	48.0
	40			13.9	29.7	13.6	57.2				13.9	20.0	14.1	48.0
40	10	100	50	15.9	33.9	15.5	65.3		86	50	15.9	22.8	16.0	54.8
	20			15.9	33.9	15.5	65.3				15.9	22.8	16.1	54.8
	30			15.9	33.9	15.5	65.4				15.9	22.9	16.1	54.8
	40			15.9	33.9	15.5	65.4				15.9	22.9	16.1	54.9
45	10	114	57	17.9	38.1	17.5	73.5		93	57	17.9	25.7	18.1	61.6
	20			17.9	38.1	17.5	73.5				17.9	25.7	18.1	61.7
	30			17.9	38.1	17.5	73.5				17.9	25.7	18.1	61.7
	40			17.9	38.2	17.5	73.6				17.9	25.7	18.1	61.7
50	10	126	63	19.9	42.3	19.4	81.6		99	63	19.9	28.5	20.1	68.5
	20			19.9	42.4	19.4	81.7				19.9	28.6	20.1	68.5
	30			19.9	42.4	19.4	81.7				19.9	28.6	20.1	68.6
	40			19.9	42.4	19.4	81.7				19.9	28.6	20.1	68.6
55	10	133	69	21.9	46.6	21.8	90.3		105	69	21.9	31.4	22.1	75.3
	20			21.9	46.6	21.8	90.3				21.9	31.4	22.1	75.4
	30			21.9	46.6	21.8	90.3				21.9	31.4	22.1	75.4
	40			21.9	46.6	21.8	90.4				21.9	31.5	22.1	75.4
60	10	139	75	23.9	50.8	23.8	98.5		111	75	23.8	34.3	24.9	83.0
	20			23.9	50.8	23.8	98.5				23.9	34.3	24.9	83.0
	30			23.9	50.9	23.8	98.6				23.9	34.3	24.9	83.0
	40			23.9	50.9	23.8	98.6				23.9	34.3	24.9	83.1
70	10	152	88	27.8	59.3	27.8	114.9		124	88	27.8	40.0	29.0	96.8
	20			27.8	59.3	27.8	114.9				27.8	40.0	29.0	96.8
	30			27.9	59.3	27.8	115.0				27.9	40.0	29.0	96.9
	40			27.9	59.4	27.8	115.0				27.9	40.0	29.0	96.9
80	10	164	100	31.8	67.7	31.7	131.3		136	100	31.8	45.7	33.1	110.6
	20			31.8	67.8	31.7	131.3				31.8	45.7	33.2	110.7
	30			31.8	67.8	31.8	131.4				31.8	45.7	33.2	110.7
	40			31.9	67.8	31.8	131.5				31.9	45.8	33.2	110.8
90	10	177	113	35.8	76.2	35.7	147.7		149	113	35.8	51.4	37.3	124.4
	20			35.8	76.2	35.7	147.8				35.8	51.4	37.3	124.5
	30			35.8	76.3	35.7	147.8				35.8	51.4	37.3	124.6
	40			35.8	76.3	35.7	147.9				35.8	51.5	37.4	124.7
100	10	189	125	39.8	84.7	39.7	164.1		161	125	39.7	57.1	41.4	138.3
	20			39.8	84.7	39.7	164.2				39.8	57.1	41.5	138.4
	30			39.8	84.8	39.7	164.3				39.8	57.2	41.5	138.4
	40			39.8	84.8	39.7	164.4				39.8	57.2	41.5	138.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	2.2	2.8	2.1	7.1		10	7	2.2	1.4	2.2	5.7
	40			2.2	2.8	2.1	7.1				2.2	1.4	2.2	5.7
	60			2.2	2.8	2.1	7.1				2.2	1.4	2.2	5.7
	80			2.2	2.8	2.1	7.1				2.2	1.4	2.2	5.7
10	20	22	14	4.3	5.7	4.3	14.3		17	14	4.3	2.8	4.4	11.5
	40			4.3	5.7	4.3	14.3				4.3	2.8	4.4	11.5
	60			4.3	5.7	4.3	14.3				4.3	2.8	4.4	11.5
	80			4.3	5.7	4.3	14.3				4.3	2.8	4.4	11.6
15	20	29	21	6.5	8.5	6.4	21.4		57	21	6.5	9.5	6.3	22.3
	40			6.5	8.5	6.4	21.5				6.5	9.5	6.3	22.3
	60			6.5	8.5	6.5	21.5				6.5	9.5	6.3	22.4
	80			6.5	8.5	6.5	21.5				6.5	9.5	6.3	22.4
20	20	36	28	8.6	11.3	8.6	28.6		64	28	8.6	12.7	8.4	29.8
	40			8.7	11.4	8.6	28.6				8.7	12.7	8.4	29.8
	60			8.7	11.4	8.6	28.7				8.7	12.7	8.4	29.8
	80			8.7	11.4	8.6	28.7				8.7	12.7	8.5	29.9
25	20	70	35	10.8	23.5	10.5	44.9		71	35	10.8	15.9	10.5	37.2
	40			10.8	23.5	10.6	44.9				10.8	15.9	10.6	37.2
	60			10.8	23.6	10.6	44.9				10.8	15.9	10.6	37.3
	80			10.8	23.6	10.6	45.0				10.8	15.9	10.6	37.3
30	20	84	42	13.0	28.2	12.7	53.8		78	42	13.0	19.0	13.1	45.1
	40			13.0	28.2	12.7	53.9				13.0	19.0	13.1	45.1
	60			13.0	28.3	12.7	53.9				13.0	19.1	13.1	45.2
	80			13.0	28.3	12.7	54.0				13.0	19.1	13.1	45.2
35	20	98	49	15.1	32.9	14.8	62.8		85	49	15.1	22.2	15.3	52.6
	40			15.1	33.0	14.8	62.9				15.1	22.2	15.3	52.7
	60			15.2	33.0	14.8	62.9				15.2	22.2	15.3	52.7
	80			15.2	33.0	14.8	63.0				15.2	22.3	15.3	52.8
40	20	112	56	17.3	37.6	16.9	71.8		92	56	17.3	25.4	17.5	60.1
	40			17.3	37.7	16.9	71.9				17.3	25.4	17.5	60.2
	60			17.3	37.7	16.9	71.9				17.3	25.4	17.5	60.2
	80			17.3	37.7	16.9	72.0				17.3	25.5	17.5	60.3
45	20	126	63	19.4	42.3	19.0	80.8		99	63	19.4	28.5	19.7	67.6
	40			19.5	42.4	19.0	80.8				19.5	28.6	19.7	67.7
	60			19.5	42.4	19.0	80.9				19.5	28.6	19.7	67.8
	80			19.5	42.5	19.0	81.0				19.5	28.6	19.7	67.8
50	20	134	70	21.6	47.0	21.6	90.2		106	70	21.6	31.7	21.8	75.1
	40			21.6	47.1	21.6	90.3				21.6	31.7	21.9	75.2
	60			21.7	47.1	21.6	90.4				21.7	31.8	21.9	75.3
	80			21.7	47.2	21.6	90.5				21.7	31.8	21.9	75.4
55	20	141	77	23.8	51.7	23.7	99.2		113	77	23.8	34.9	24.8	83.5
	40			23.8	51.8	23.8	99.3				23.8	34.9	24.9	83.6
	60			23.8	51.8	23.8	99.4				23.8	35.0	24.9	83.7
	80			23.8	51.9	23.8	99.5				23.9	35.0	24.9	83.8
60	20	148	84	25.9	56.4	25.9	108.3		120	84	25.9	38.1	27.1	91.1
	40			26.0	56.5	25.9	108.4				26.0	38.1	27.1	91.2
	60			26.0	56.5	25.9	108.5				26.0	38.1	27.1	91.3
	80			26.0	56.6	26.0	108.6				26.0	38.2	27.2	91.4
70	20	162	98	30.2	65.8	30.2	126.3		134	98	30.2	44.4	31.6	106.3
	40			30.3	65.9	30.2	126.4				30.3	44.4	31.6	106.4
	60			30.3	66.0	30.3	126.5				30.3	44.5	31.7	106.5
	80			30.3	66.0	30.3	126.7				30.4	44.5	31.7	106.6
80	20	176	112	34.6	75.2	34.5	144.3		148	112	34.6	50.7	36.2	121.5
	40			34.6	75.3	34.6	144.5				34.6	50.8	36.2	121.6
	60			34.6	75.4	34.6	144.6				34.6	50.9	36.2	121.7
	80			34.7	75.5	34.6	144.8				34.7	50.9	36.3	121.9
90	20	189	125	38.9	84.7	38.8	162.4		161	125	38.9	57.1	40.7	136.6
	40			38.9	84.7	38.9	162.5				38.9	57.1	40.7	136.8
	60			39.0	84.8	38.9	162.7				39.0	57.2	40.8	136.9
	80			39.0	84.9	38.9	162.9				39.0	57.3	40.8	137.1
100	20	203	139	43.2	94.1	44.1	181.4		175	139	43.2	63.4	45.2	151.8
	40			43.3	94.2	44.2	181.6				43.3	63.5	45.2	152.0
	60			43.3	94.2	44.2	181.8				43.3	63.6	45.3	152.2
	80			43.4	94.3	44.3	181.9				43.4	63.6	45.3	152.3

## 400 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CH LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED	MOD A	MOD B	SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME				PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	2.8	3.6	2.8	9.3	12		9	2.8	1.8	2.8	7.5
	40			2.8	3.6	2.8	9.3				2.8	1.8	2.8	7.5
	60			2.8	3.7	2.8	9.3				2.8	1.8	2.8	7.5
	80			2.8	3.7	2.8	9.3				2.8	1.8	2.8	7.5
10	20	26	18	5.7	7.3	5.6	18.6	21		18	5.7	3.6	5.7	14.9
	40			5.7	7.3	5.6	18.6				5.7	3.6	5.7	14.9
	60			5.7	7.3	5.6	18.6				5.7	3.6	5.7	14.9
	80			5.7	7.3	5.6	18.6				5.7	3.6	5.7	15.0
15	20	35	27	8.5	10.9	8.5	27.9	63		27	8.5	12.2	8.3	29.0
	40			8.5	10.9	8.5	27.9				8.5	12.2	8.3	29.1
	60			8.5	11.0	8.5	27.9				8.5	12.2	8.3	29.1
	80			8.5	11.0	8.5	28.0				8.5	12.3	8.3	29.1
20	20	72	36	11.3	24.2	11.1	46.6	72		36	11.3	16.3	11.1	38.7
	40			11.3	24.2	11.1	46.6				11.3	16.3	11.1	38.7
	60			11.4	24.2	11.1	46.6				11.4	16.3	11.1	38.8
	80			11.4	24.2	11.1	46.7				11.4	16.3	11.1	38.8
25	20	90	45	14.2	30.2	13.9	58.2	81		45	14.2	20.4	14.3	48.8
	40			14.2	30.2	13.9	58.3				14.2	20.4	14.3	48.9
	60			14.2	30.2	13.9	58.3				14.2	20.4	14.3	48.9
	80			14.2	30.3	13.9	58.4				14.2	20.4	14.3	49.0
30	20	108	54	17.0	36.2	16.6	69.9	90		54	17.0	24.4	17.2	58.6
	40			17.0	36.3	16.6	69.9				17.0	24.5	17.2	58.7
	60			17.0	36.3	16.6	70.0				17.0	24.5	17.2	58.7
	80			17.0	36.3	16.7	70.0				17.0	24.5	17.2	58.8
35	20	126	63	19.8	42.3	19.4	81.5	99		63	19.8	28.5	20.0	68.4
	40			19.9	42.3	19.4	81.6				19.8	28.5	20.1	68.4
	60			19.9	42.3	19.4	81.6				19.9	28.6	20.1	68.5
	80			19.9	42.4	19.4	81.7				19.9	28.6	20.1	68.6
40	20	136	72	22.7	48.3	22.6	93.6	108		72	22.7	32.6	22.9	78.2
	40			22.7	48.4	22.7	93.7				22.7	32.6	22.9	78.2
	60			22.7	48.4	22.7	93.8				22.7	32.6	22.9	78.3
	80			22.7	48.4	22.7	93.9				22.7	32.7	22.9	78.3
45	20	145	81	25.5	54.4	25.5	105.3	117		81	25.5	36.7	26.6	88.8
	40			25.5	54.4	25.5	105.4				25.5	36.7	26.6	88.8
	60			25.5	54.4	25.5	105.5				25.5	36.7	26.6	88.9
	80			25.6	54.5	25.5	105.6				25.6	36.8	26.7	89.0
50	20	154	90	28.3	60.4	28.3	117.0	126		90	28.3	40.7	29.6	98.6
	40			28.4	60.4	28.3	117.1				28.4	40.8	29.6	98.7
	60			28.4	60.5	28.3	117.2				28.4	40.8	29.6	98.8
	80			28.4	60.5	28.4	117.3				28.4	40.8	29.6	98.9
55	20	163	99	31.2	66.4	31.1	128.7	135		99	31.2	44.8	32.5	108.5
	40			31.2	66.5	31.2	128.8				31.2	44.8	32.5	108.6
	60			31.2	66.5	31.2	128.9				31.2	44.9	32.6	108.7
	80			31.2	66.6	31.2	129.0				31.2	44.9	32.6	108.8
60	20	172	108	34.0	72.5	34.0	140.5	144		108	34.0	48.9	35.5	118.3
	40			34.0	72.5	34.0	140.6				34.0	48.9	35.5	118.4
	60			34.1	72.6	34.0	140.7				34.1	49.0	35.5	118.5
	80			34.1	72.7	34.0	140.8				34.1	49.0	35.5	118.6
70	20	189	125	39.7	84.5	39.6	163.9	161		125	39.7	57.0	41.4	138.1
	40			39.7	84.6	39.7	164.0				39.7	57.1	41.4	138.2
	60			39.7	84.7	39.7	164.1				39.7	57.1	41.5	138.3
	80			39.8	84.8	39.7	164.2				39.8	57.2	41.5	138.4
80	20	207	143	45.3	96.6	46.3	188.2	179		143	45.3	65.2	47.3	157.8
	40			45.4	96.7	46.3	188.4				45.4	65.2	47.4	158.0
	60			45.4	96.8	46.3	188.5				45.4	65.3	47.4	158.1
	80			45.5	96.9	46.4	188.7				45.5	65.3	47.4	158.2
90	20	225	161	51.0	108.7	52.1	211.8	197		161	51.0	73.3	56.6	180.9
	40			51.1	108.8	52.1	211.9				51.0	73.4	56.6	181.0
	60			51.1	108.9	52.1	212.1				51.1	73.4	56.7	181.2
	80			51.1	109.0	52.2	212.3				51.1	73.5	56.7	181.3
100	20	243	179	56.7	120.8	57.8	235.3	215		179	56.7	81.5	62.8	201.0
	40			56.7	120.9	57.9	235.5				56.7	81.5	62.9	201.1
	60			56.8	121.0	57.9	235.7				56.8	81.6	62.9	201.3
	80			56.8	121.1	58.0	235.9				56.8	81.7	63.0	201.5

## 500 CHARACTER DATA RECORD

7010/1301 DISK INPUT AND OUTPUT 7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	3.7	5.1	3.7	12.5		16	13	3.7	2.5	3.8	10.0
	40			3.7	5.1	3.7	12.5				3.7	2.5	3.8	10.0
	60			3.7	5.1	3.7	12.5				3.7	2.5	3.8	10.0
	80			3.7	5.1	3.7	12.5				3.7	2.5	3.8	10.0
10	20	33	25	7.4	10.2	7.4	25.0		61	25	7.4	11.4	7.2	26.0
	40			7.4	10.2	7.4	25.0				7.4	11.4	7.2	26.1
	60			7.4	10.2	7.4	25.0				7.4	11.4	7.3	26.1
	80			7.4	10.2	7.4	25.0				7.4	11.4	7.3	26.1
15	20	76	38	11.1	25.3	10.9	47.3		74	38	11.1	17.1	11.3	39.5
	40			11.1	25.3	10.9	47.3				11.1	17.1	11.3	39.5
	60			11.1	25.3	10.9	47.3				11.1	17.1	11.3	39.5
	80			11.1	25.4	10.9	47.4				11.1	17.1	11.3	39.5
20	20	100	50	14.8	33.7	14.5	63.0		86	50	14.8	22.8	15.0	52.6
	40			14.8	33.8	14.5	63.1				14.8	22.8	15.0	52.7
	60			14.8	33.8	14.5	63.1				14.8	22.8	15.1	52.7
	80			14.8	33.8	14.5	63.2				14.8	22.8	15.1	52.7
25	20	126	63	18.5	42.2	18.1	78.8		99	63	18.5	28.4	18.8	65.8
	40			18.5	42.2	18.1	78.9				18.5	28.5	18.8	65.8
	60			18.5	42.2	18.1	78.9				18.5	28.5	18.8	65.9
	80			18.6	42.3	18.1	79.0				18.6	28.5	18.8	65.9
30	20	139	75	22.2	50.6	22.3	95.1		111	75	22.2	34.1	23.4	79.8
	40			22.2	50.6	22.3	95.2				22.2	34.2	23.4	79.8
	60			22.3	50.7	22.3	95.2				22.3	34.2	23.4	79.9
	80			22.3	50.7	22.3	95.3				22.3	34.2	23.5	79.9
35	20	152	88	25.9	59.0	26.0	111.0		124	88	25.9	39.8	27.3	93.1
	40			26.0	59.1	26.0	111.0				25.9	39.9	27.3	93.1
	60			26.0	59.1	26.0	111.1				26.0	39.9	27.3	93.2
	80			26.0	59.2	26.0	111.2				26.0	39.9	27.4	93.3
40	20	164	100	29.6	67.5	29.7	126.8		136	100	29.6	45.5	31.2	106.4
	40			29.7	67.5	29.7	126.9				29.7	45.6	31.2	106.4
	60			29.7	67.6	29.7	127.0				29.7	45.6	31.3	106.5
	80			29.7	67.6	29.7	127.0				29.7	45.6	31.3	106.6
45	20	177	113	33.3	75.9	33.4	142.7		149	113	33.3	51.2	35.2	119.7
	40			33.4	76.0	33.4	142.7				33.4	51.2	35.2	119.8
	60			33.4	76.0	33.4	142.8				33.4	51.3	35.2	119.9
	80			33.4	76.1	33.5	142.9				33.4	51.3	35.2	119.9
50	20	189	125	37.1	84.3	37.1	158.5		161	125	37.0	56.9	39.1	133.0
	40			37.1	84.4	37.1	158.6				37.1	56.9	39.1	133.1
	60			37.1	84.4	37.2	158.7				37.1	57.0	39.1	133.2
	80			37.1	84.5	37.2	158.8				37.1	57.0	39.1	133.3
55	20	202	138	40.8	92.8	41.9	175.4		174	138	40.7	62.6	43.0	146.3
	40			40.8	92.8	41.9	175.5				40.8	62.6	43.0	146.4
	60			40.8	92.9	41.9	175.6				40.8	62.7	43.0	146.5
	80			40.8	93.0	41.9	175.7				40.8	62.7	43.0	146.6
60	20	214	150	44.5	101.2	45.7	191.3		186	150	44.4	68.3	50.3	163.0
	40			44.5	101.3	45.7	191.4				44.5	68.3	50.3	163.1
	60			44.5	101.3	45.7	191.6				44.5	68.4	50.3	163.2
	80			44.5	101.4	45.7	191.7				44.5	68.4	50.4	163.3
65	20	227	163	48.2	109.6	49.5	207.3		199	163	48.1	74.0	54.5	176.6
	40			48.2	109.7	49.5	207.4				48.2	74.0	54.5	176.7
	60			48.2	109.8	49.5	207.5				48.2	74.1	54.5	176.8
	80			48.3	109.9	49.6	207.7				48.2	74.1	54.6	176.9
70	20	239	175	51.9	118.1	53.3	223.2		211	175	51.9	79.7	58.7	190.2
	40			51.9	118.1	53.3	223.4				51.9	79.7	58.7	190.3
	60			51.9	118.2	53.3	223.5				51.9	79.8	58.7	190.4
	80			52.0	118.3	53.4	223.6				52.0	79.8	58.8	190.6
75	20	247	192	55.6	126.5	57.1	239.2		224	188	55.6	85.3	62.8	203.7
	40			55.6	126.6	57.1	239.3				55.6	85.4	62.9	203.9
	60			55.6	126.7	57.1	239.5				55.6	85.5	62.9	204.0
	80			55.7	126.8	57.2	239.6				55.7	85.5	63.0	204.2

## 750 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	5.8	8.5	5.8	20.1	57	21	5.8	9.4	5.7	20.9
	40			5.8	8.5	5.8	20.1			5.8	9.4	5.7	20.9
	60			5.8	8.5	5.8	20.1			5.8	9.5	5.7	20.9
	80			5.8	8.5	5.8	20.1			5.8	9.5	5.7	21.0
10	20	84	42	11.6	28.0	11.4	50.9	78	42	11.6	18.9	11.8	42.3
	40			11.6	28.0	11.4	51.0			11.6	18.9	11.8	42.4
	60			11.6	28.0	11.4	51.0			11.6	18.9	11.8	42.4
	80			11.6	28.0	11.4	51.0			11.6	18.9	11.8	42.4
15	20	126	63	17.4	41.9	17.0	76.4	99	63	17.4	28.3	17.7	63.5
	40			17.4	42.0	17.0	76.4			17.4	28.3	17.8	63.5
	60			17.4	42.0	17.1	76.5			17.4	28.4	17.8	63.6
	80			17.4	42.0	17.1	76.5			17.4	28.4	17.8	63.6
20	20	148	84	23.2	55.9	23.3	102.5	120	84	23.2	37.8	24.7	85.7
	40			23.2	56.0	23.3	102.5			23.2	37.8	24.7	85.7
	60			23.3	56.0	23.4	102.6			23.2	37.8	24.7	85.8
	80			23.3	56.0	23.4	102.6			23.2	37.8	24.7	85.8
25	20	169	105	29.0	69.9	29.2	128.1	141	105	29.0	47.2	30.8	107.1
	40			29.1	69.9	29.2	128.2			29.0	47.2	30.9	107.1
	60			29.1	70.0	29.2	128.2			29.1	47.3	30.9	107.2
	80			29.1	70.0	29.2	128.3			29.1	47.3	30.9	107.3
30	20	189	125	34.9	83.9	35.0	153.7	161	125	34.8	56.7	37.1	128.6
	40			34.9	83.9	35.0	153.8			34.8	56.7	37.1	128.6
	60			34.9	84.0	35.0	153.9			34.9	56.7	37.1	128.7
	80			34.9	84.0	35.0	154.0			34.9	56.8	37.1	128.8
40	20	231	167	46.5	111.9	48.0	206.3	203	167	46.4	75.5	53.5	175.5
	40			46.5	111.9	48.0	206.4			46.5	75.6	53.5	175.6
	60			46.5	112.0	48.0	206.5			46.5	75.6	53.6	175.7
	80			46.5	112.0	48.1	206.6			46.5	75.7	53.6	175.8
45	20	250	192	52.7	126.8	54.4	234.0	225	189	52.7	85.7	60.7	199.0
	40			52.7	126.9	54.4	234.1			52.7	85.7	60.7	199.1
	60			52.7	127.0	54.5	234.2			52.7	85.8	60.7	199.2
	80			52.7	127.1	54.5	234.3			52.7	85.8	60.8	199.3

## 1000 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	40	32	8.2	12.6	8.2	29.0	68	32	8.2	14.1	8.0	30.2
	40			8.2	12.6	8.2	29.0			8.2	14.1	8.0	30.2
	60			8.2	12.6	8.2	29.0			8.2	14.1	8.0	30.3
	80			8.2	12.7	8.2	29.0			8.2	14.1	8.0	30.3
10	20	126	63	16.3	41.6	16.0	73.9	99	63	16.3	28.1	16.7	61.2
	40			16.3	41.6	16.0	73.9			16.3	28.2	16.7	61.2
	60			16.4	41.6	16.0	74.0			16.3	28.2	16.7	61.2
	80			16.4	41.6	16.0	74.0			16.3	28.2	16.7	61.2
15	20	158	94	24.5	62.4	24.6	111.5	130	94	24.5	42.2	26.2	92.9
	40			24.5	62.4	24.7	111.6			24.5	42.2	26.2	93.0
	60			24.5	62.4	24.7	111.6			24.5	42.3	26.2	93.0
	80			24.5	62.5	24.7	111.7			24.5	42.3	26.2	93.0
20	20	189	125	32.7	83.2	32.9	148.7	161	125	32.7	56.3	35.1	124.0
	40			32.7	83.2	32.9	148.8			32.7	56.3	35.1	124.1
	60			32.7	83.3	32.9	148.8			32.7	56.3	35.1	124.1
	80			32.7	83.3	32.9	148.9			32.7	56.4	35.1	124.2
25	20	221	157	40.9	104.0	42.4	187.2	193	157	40.8	70.4	47.9	159.1
	40			40.9	104.0	42.4	187.3			40.9	70.4	47.9	159.2
	60			40.9	104.1	42.4	187.4			40.9	70.4	47.9	159.2
	80			40.9	104.1	42.4	187.4			40.9	70.5	47.9	159.3
30	20	247	192	49.0	124.8	50.8	224.6	224	188	49.0	84.4	57.5	190.9
	40			49.0	124.8	50.9	224.7			49.0	84.5	57.5	191.0
	60			49.1	124.9	50.9	224.8			49.0	84.5	57.5	191.1
	80			49.1	124.9	50.9	224.9			49.0	84.6	57.5	191.1

## 1500 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				MOD A	MOD B	CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME					PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	2.8	4.8	2.8	10.4	16	13	2.8	2.4	2.8	8.0	2.8	8.0
	40			2.8	4.8	2.8	10.4								
	60			2.8	4.8	2.8	10.4								
	80			2.8	4.8	2.8	10.4								
2	20	33	25	5.7	9.6	5.5	20.8	61	25	5.7	9.6	5.5	20.8	5.7	20.8
	40			5.7	9.6	5.5	20.8								
	60			5.7	9.6	5.5	20.8								
	80			5.7	9.6	5.5	20.8								
3	20	76	38	8.5	21.6	8.3	38.4	74	38	8.5	14.4	8.3	31.2	8.5	31.2
	40			8.5	21.6	8.3	38.4								
	60			8.5	21.6	8.3	38.4								
	80			8.5	21.6	8.3	38.4								
4	20	100	50	11.4	28.8	11.1	51.2	86	50	11.4	19.2	11.1	41.6	11.4	41.6
	40			11.4	28.8	11.1	51.2								
	60			11.4	28.8	11.1	51.2								
	80			11.4	28.8	11.1	51.3								
5	20	126	63	14.2	36.0	13.8	64.0	99	63	14.2	24.0	13.8	52.0	14.2	52.0
	40			14.2	36.0	13.8	64.0								
	60			14.2	36.0	13.8	64.1								
	80			14.2	36.0	13.9	64.1								
10	20	189	125	28.4	71.9	27.7	128.0	161	125	28.4	48.0	27.7	104.0	28.4	104.1
	40			28.4	72.0	27.7	128.1								
	60			28.4	72.0	27.7	128.1								
	80			28.4	72.0	27.7	128.2								
15	20	247	192	42.6	107.9	41.5	192.0	224	188	42.6	71.9	41.5	156.0	42.6	156.1
	40			42.6	107.9	41.5	192.1								
	60			42.6	108.0	41.6	192.2								
	80			42.6	108.1	41.6	192.3								

## 2000 CHARACTER DATA RECORD

7010/1301 DISK

INPUT AND OUTPUT

7330 TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				MOD A	MOD B	CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME					PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	3.3	4.8	3.2	11.3	16	13	3.3	2.4	3.2	8.9	3.3	8.9
	40			3.3	4.8	3.2	11.3								
	60			3.3	4.8	3.2	11.3								
	80			3.3	4.8	3.2	11.3								
2	20	33	25	6.5	9.6	6.4	22.5	61	25	6.5	9.6	6.4	22.5	6.5	22.5
	40			6.5	9.6	6.4	22.5								
	60			6.5	9.6	6.4	22.5								
	80			6.5	9.6	6.4	22.5								
3	20	76	38	9.8	21.6	9.6	41.0	74	38	9.8	14.4	9.6	33.8	9.8	33.8
	40			9.8	21.6	9.6	41.0								
	60			9.8	21.6	9.6	41.0								
	80			9.8	21.6	9.6	41.0								
4	20	100	50	13.1	28.8	12.8	54.7	86	50	13.1	19.2	12.8	45.1	13.1	45.1
	40			13.1	28.8	12.8	54.7								
	60			13.1	28.8	12.8	54.7								
	80			13.1	28.9	12.8	54.7								
5	20	126	63	16.3	36.0	16.0	68.3	99	63	16.3	24.0	16.0	56.3	16.3	56.3
	40			16.3	36.0	16.0	68.3								
	60			16.3	36.1	16.0	68.4								
	80			16.3	36.1	16.0	68.4								
10	20	189	125	32.7	72.0	31.9	136.6	161	125	32.6	48.0	31.9	112.6	32.6	112.6
	40			32.7	72.1	31.9	136.7								
	60			32.7	72.1	32.0	136.7								
	80			32.7	72.1	32.0	136.8								
15	20	247	192	49.0	108.0	47.9	205.0	224	188	49.0	72.0	47.9	168.9	49.0	169.0
	40			49.0	108.1	47.9	205.0								
	60			49.0	108.2	47.9	205.1								
	80			49.0	108.2	48.0	205.2								

## 20 CHARACTER DATA RECORD

7010/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	1	1	.2	.0	.1	.3	1	1	.2	.0	.1	.3
	10			.2	.0	.1	.3			.2	.0	.1	.3
	15			.2	.0	.1	.3			.3	.0	.1	.3
10	5	2	1	.4	.2	.2	.8	1	1	.5	.0	.2	.6
	10			.5	.2	.2	.9			.5	.0	.2	.7
	15			.5	.2	.2	.9			.5	.0	.2	.7
20	5	3	2	.9	.4	.4	1.7	4	2	.9	.4	.4	1.7
	10			.9	.4	.4	1.8			1.0	.5	.4	1.8
	15			1.0	.4	.4	1.8			1.0	.5	.4	1.9
30	5	4	3	1.3	.6	.7	2.6	6	3	1.4	.7	.6	2.6
	10			1.4	.6	.7	2.7			1.5	.7	.6	2.7
	15			1.5	.6	.7	2.8			1.5	.7	.6	2.8
40	5	5	4	1.8	.8	.9	3.5	7	4	1.9	.9	.8	3.6
	10			1.9	.8	.9	3.6			2.0	.9	.8	3.7
	15			1.9	.9	1.0	3.8			2.1	1.0	.9	3.9
50	5	13	5	2.2	2.0	.9	5.2	8	5	2.3	1.1	1.0	4.5
	10			2.3	2.1	.9	5.4			2.4	1.2	1.1	4.7
	15			2.4	2.2	1.0	5.6			2.6	1.2	1.1	4.9
75	5	15	7	3.3	3.1	1.4	7.8	10	7	3.5	1.7	1.7	6.8
	10			3.5	3.2	1.4	8.1			3.7	1.7	1.7	7.1
	15			3.6	3.3	1.5	8.4			3.8	1.8	1.8	7.4
100	5	17	9	4.4	4.1	2.1	10.5	12	9	4.6	2.2	2.2	9.1
	10			4.6	4.2	2.1	11.0			4.9	2.3	2.3	9.5
	15			4.8	4.4	2.2	11.4			5.1	2.4	2.4	9.9
125	5	20	12	5.5	5.1	2.6	13.2	15	12	5.8	2.8	2.9	11.5
	10			5.8	5.3	2.6	13.7			6.1	2.9	3.0	12.0
	15			6.0	5.5	2.7	14.2			6.4	3.0	3.1	12.5
150	5	22	14	6.6	6.1	3.1	15.8	17	14	7.0	3.3	3.7	14.0
	10			6.9	6.3	3.2	16.4			7.3	3.5	3.8	14.6
	15			7.3	6.5	3.3	17.1			7.7	3.6	3.9	15.3
175	5	24	16	7.7	7.1	3.6	18.5	19	16	8.1	3.9	4.3	16.3
	10			8.1	7.4	3.7	19.2			8.6	4.1	4.5	17.1
	15			8.5	7.6	3.8	19.9			9.0	4.2	4.6	17.8
200	5	26	18	8.8	8.1	4.4	21.4	21	18	9.3	4.5	4.9	18.7
	10			9.3	8.4	4.6	22.3			9.8	4.6	5.1	19.5
	15			9.7	8.7	4.7	23.1			10.3	4.8	5.3	20.3
250	5	31	23	11.0	10.2	5.5	26.8	59	23	11.6	11.6	4.6	27.9
	10			11.6	10.5	5.7	27.8			12.2	12.0	4.7	29.0
	15			12.1	10.9	5.9	28.9			12.8	12.5	4.8	30.1
300	5	35	27	13.2	12.2	6.9	32.4	63	27	13.9	13.9	5.6	33.5
	10			13.9	12.6	7.2	33.7			14.7	14.4	5.7	34.8
	15			14.5	13.1	7.4	35.0			15.4	15.0	5.8	36.2
350	5	40	32	15.5	14.2	8.1	37.8	68	32	16.3	16.3	6.5	39.0
	10			16.2	14.8	8.4	39.3			17.1	16.9	6.6	40.6
	15			16.9	15.3	8.6	40.8			18.0	17.5	6.8	42.2
400	5	72	36	17.7	25.9	7.4	51.0	72	36	18.6	18.6	7.4	44.6
	10			18.5	26.7	7.6	52.8			19.6	19.3	7.6	46.4
	15			19.4	27.5	7.7	54.6			20.5	19.9	7.7	48.2

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOO B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOO B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.2	.1	.1	.5	1	1	.2	.0	.1	.3
	10			.2	.1	.1	.5			.2	.0	.1	.3
	15			.3	.1	.1	.5			.3	.0	.1	.3
	20			.3	.1	.1	.5			.3	.0	.1	.4
10	5	3	2	.5	.2	.3	1.0	2	1	.5	.0	.3	.7
	10			.5	.2	.3	1.0			.5	.0	.3	.7
	15			.5	.3	.3	1.0			.5	.0	.3	.8
	20			.5	.3	.3	1.1			.5	.0	.3	.8
20	5	4	3	.9	.5	.5	1.9	6	3	.9	.5	.5	1.9
	10			1.0	.5	.5	2.0			1.0	.6	.5	2.0
	15			1.0	.5	.6	2.1			1.0	.6	.5	2.1
	20			1.0	.5	.6	2.1			1.1	.6	.5	2.1
30	5	13	5	1.4	1.5	.7	3.6	8	5	1.4	.8	.8	3.0
	10			1.4	1.5	.7	3.7			1.5	.8	.8	3.1
	15			1.5	1.6	.7	3.8			1.5	.9	.8	3.2
	20			1.6	1.6	.7	3.9			1.6	.9	.8	3.3
40	5	14	6	1.8	2.0	.9	4.8	9	6	1.9	1.1	1.0	4.0
	10			1.9	2.1	1.0	4.9			2.0	1.1	1.1	4.1
	15			2.0	2.1	1.0	5.1			2.0	1.1	1.1	4.3
	20			2.1	2.2	1.0	5.2			2.1	1.2	1.1	4.4
50	5	15	7	2.3	2.5	1.2	6.0	10	7	2.3	1.3	1.4	5.1
	10			2.4	2.6	1.2	6.2			2.4	1.4	1.4	5.3
	15			2.5	2.6	1.2	6.4			2.6	1.4	1.5	5.4
	20			2.6	2.7	1.2	6.5			2.7	1.5	1.5	5.6
75	5	19	11	3.5	3.7	1.9	9.1	14	11	3.5	2.0	2.2	7.7
	10			3.6	3.9	2.0	9.4			3.7	2.1	2.2	8.0
	15			3.8	4.0	2.0	9.7			3.8	2.2	2.3	8.3
	20			3.9	4.1	2.1	10.0			4.0	2.2	2.3	8.5
100	5	22	14	4.6	5.0	2.6	12.2	17	14	4.7	2.7	3.1	10.4
	10			4.8	5.1	2.6	12.6			4.9	2.8	3.1	10.8
	15			5.0	5.3	2.7	13.0			5.1	2.9	3.2	11.2
	20			5.2	5.4	2.7	13.4			5.3	3.0	3.3	11.6
125	5	25	17	5.8	6.2	3.4	15.4	20	17	5.8	3.4	3.8	13.0
	10			6.0	6.4	3.5	16.0			6.1	3.5	3.9	13.5
	15			6.3	6.6	3.6	16.5			6.4	3.6	4.0	14.0
	20			6.5	6.8	3.7	17.0			6.7	3.7	4.2	14.5
150	5	29	21	6.9	7.5	4.1	18.5	57	21	7.0	8.7	3.5	19.2
	10			7.2	7.7	4.2	19.2			7.3	8.9	3.6	19.8
	15			7.5	7.9	4.3	19.8			7.7	9.2	3.6	20.4
	20			7.8	8.1	4.4	20.4			8.0	9.4	3.7	21.1
175	5	32	24	8.1	8.7	4.8	21.6	60	24	8.1	10.2	4.1	22.4
	10			8.4	9.0	4.9	22.3			8.5	10.4	4.2	23.1
	15			8.8	9.2	5.1	23.1			8.9	10.7	4.2	23.9
	20			9.1	9.5	5.2	23.8			9.3	11.0	4.3	24.6
200	5	35	27	9.2	10.0	5.7	24.9	63	27	9.3	11.6	4.7	25.6
	10			9.6	10.3	5.8	25.7			9.8	11.9	4.8	26.4
	15			10.0	10.6	6.0	26.6			10.2	12.2	4.8	27.3
	20			10.4	10.8	6.1	27.4			10.7	12.5	4.9	28.1
250	5	68	34	11.5	20.8	5.8	38.1	70	34	11.6	14.5	5.8	32.0
	10			12.0	21.2	5.9	39.2			12.2	14.9	5.9	33.0
	15			12.5	21.6	6.0	40.2			12.8	15.3	6.0	34.1
	20			13.0	22.1	6.1	41.3			13.3	15.7	6.1	35.1
300	5	82	41	13.8	24.9	7.0	45.8	77	41	14.0	17.4	8.2	39.6
	10			14.4	25.4	7.1	47.0			14.6	17.9	8.4	40.9
	15			15.0	26.0	7.2	48.2			15.3	18.3	8.5	42.2
	20			15.7	26.5	7.4	49.5			16.0	18.8	8.7	43.5
350	5	96	48	16.1	29.1	8.2	53.4	84	48	16.3	20.3	9.6	46.2
	10			16.8	29.7	8.3	54.8			17.1	20.9	9.8	47.7
	15			17.6	30.3	8.4	56.3			17.9	21.4	10.0	49.2
	20			18.3	30.9	8.6	57.8			18.7	22.0	10.2	50.8
400	5	108	54	18.4	33.2	9.3	61.0	90	54	18.6	23.2	10.9	52.8
	10			19.3	33.9	9.5	62.7			19.5	23.8	11.2	54.5
	15			20.1	34.6	9.7	64.3			20.4	24.5	11.4	56.3
	20			20.9	35.3	9.8	66.0			21.3	25.1	11.6	58.0



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.2	.1	.1	.5	1	1	.2	.0	.2	.3
	10			.2	.1	.1	.5			.2	.0	.2	.4
	15			.3	.1	.1	.5			.3	.0	.2	.4
	20			.3	.2	.1	.6			.3	.0	.2	.4
10	5	3	2	.5	.3	.3	1.0	4	2	.5	.3	.3	1.1
	10			.5	.3	.3	1.1			.5	.3	.3	1.1
	15			.5	.3	.3	1.1			.5	.3	.3	1.1
	20			.5	.3	.3	1.1			.5	.3	.3	1.2
20	5	5	4	.9	.6	.7	2.2	7	4	1.0	.6	.6	2.2
	10			1.0	.6	.7	2.2			1.0	.7	.6	2.3
	15			1.0	.6	.7	2.3			1.0	.7	.6	2.3
	20			1.1	.6	.7	2.4			1.1	.7	.7	2.4
30	5	14	6	1.4	1.8	.8	4.0	9	6	1.4	1.0	.9	3.3
	10			1.5	1.8	.9	4.1			1.5	1.0	.9	3.4
	15			1.5	1.9	.9	4.3			1.6	1.0	1.0	3.5
	20			1.6	1.9	.9	4.4			1.6	1.0	1.0	3.6
40	5	16	8	1.9	2.4	1.1	5.4	11	8	1.9	1.3	1.3	4.5
	10			2.0	2.4	1.1	5.5			2.0	1.3	1.4	4.6
	15			2.0	2.5	1.2	5.7			2.1	1.3	1.4	4.8
	20			2.1	2.5	1.2	5.8			2.2	1.4	1.4	4.9
50	5	17	9	2.3	3.0	1.5	6.9	12	9	2.4	1.6	1.7	5.6
	10			2.4	3.0	1.6	7.0			2.5	1.6	1.7	5.8
	15			2.5	3.1	1.6	7.2			2.6	1.7	1.7	6.0
	20			2.6	3.2	1.6	7.4			2.7	1.7	1.8	6.2
75	5	22	14	3.5	4.5	2.3	10.3	17	14	3.6	2.4	2.8	8.7
	10			3.7	4.6	2.3	10.6			3.7	2.4	2.8	9.0
	15			3.8	4.7	2.4	10.9			3.9	2.5	2.9	9.3
	20			4.0	4.8	2.4	11.2			4.0	2.6	3.0	9.6
100	5	26	18	4.7	5.9	3.3	13.9	21	18	4.8	3.2	3.7	11.6
	10			4.9	6.1	3.3	14.3			5.0	3.3	3.8	12.0
	15			5.1	6.2	3.4	14.7			5.2	3.3	3.9	12.4
	20			5.3	6.3	3.5	15.1			5.4	3.4	3.9	12.8
125	5	31	23	5.9	7.4	4.1	17.4	59	23	5.9	8.8	3.5	18.2
	10			6.1	7.6	4.2	17.9			6.2	9.0	3.6	18.7
	15			6.4	7.8	4.3	18.4			6.5	9.1	3.6	19.2
	20			6.6	7.9	4.4	18.9			6.7	9.3	3.7	19.7
150	5	35	27	7.0	8.9	5.0	21.0	63	27	7.1	10.5	4.2	21.9
	10			7.3	9.1	5.2	21.6			7.4	10.7	4.3	22.5
	15			7.6	9.3	5.3	22.2			7.8	11.0	4.3	23.0
	20			7.9	9.5	5.4	22.8			8.1	11.2	4.4	23.6
175	5	40	32	8.2	10.4	5.9	24.5	68	32	8.3	12.3	4.9	25.5
	10			8.6	10.6	6.0	25.2			8.7	12.5	5.0	26.2
	15			8.9	10.9	6.2	25.9			9.1	12.8	5.0	26.9
	20			9.2	11.1	6.3	26.7			9.4	13.0	5.1	27.6
200	5	72	36	9.4	20.5	5.6	35.5	72	36	9.5	14.1	5.6	29.2
	10			9.8	20.8	5.7	36.3			9.9	14.3	5.7	29.9
	15			10.2	21.1	5.8	37.0			10.4	14.6	5.8	30.7
	20			10.6	21.4	5.8	37.8			10.8	14.9	5.8	31.5
250	5	90	45	11.7	25.6	7.0	44.4	81	45	11.9	17.6	8.3	37.8
	10			12.2	26.0	7.1	45.3			12.4	17.9	8.5	38.8
	15			12.7	26.3	7.2	46.3			12.9	18.3	8.6	39.8
	20			13.2	26.7	7.3	47.2			13.5	18.6	8.8	40.9
300	5	108	54	14.1	30.7	8.4	53.3	90	54	14.3	21.1	10.0	45.4
	10			14.7	31.2	8.5	54.4			14.9	21.5	10.2	46.6
	15			15.3	31.6	8.7	55.5			15.5	21.9	10.4	47.8
	20			15.8	32.1	8.8	56.7			16.2	22.3	10.5	49.0
350	5	126	63	16.4	35.9	9.8	62.1	99	63	16.6	24.6	11.7	52.9
	10			17.1	36.4	10.0	63.4			17.4	25.1	11.9	54.3
	15			17.8	36.9	10.1	64.8			18.1	25.6	12.1	55.8
	20			18.5	37.4	10.2	66.1			18.9	26.1	12.3	57.2
400	5	136	72	18.8	41.0	13.1	72.9	108	72	19.0	28.1	13.3	60.5
	10			19.6	41.6	13.3	74.4			19.9	28.7	13.6	62.1
	15			20.3	42.1	13.5	76.0			20.7	29.2	13.8	63.7
	20			21.1	42.8	13.8	77.6			21.6	29.8	14.0	65.4

## 50 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.3	.2	.2	.6	2	1	.3	.0	.2	.4
	20			.3	.2	.2	.6			.3	.0	.2	.4
	30			.3	.2	.2	.7			.3	.0	.2	.5
	40			.3	.2	.2	.7			.3	.0	.2	.5
10	10	4	3	.5	.3	.4	1.2	6	3	.5	.4	.3	1.2
	20			.5	.3	.4	1.3			.6	.4	.3	1.3
	30			.6	.4	.4	1.3			.6	.4	.3	1.4
	40			.6	.4	.4	1.4			.6	.4	.4	1.4
20	10	13	5	1.0	1.5	.6	3.1	8	5	1.0	.7	.7	2.5
	20			1.1	1.5	.7	3.2			1.1	.8	.8	2.6
	30			1.2	1.5	.7	3.4			1.2	.8	.8	2.8
	40			1.2	1.6	.7	3.5			1.3	.9	.8	2.9
30	10	15	7	1.5	2.2	1.0	4.7	10	7	1.5	1.1	1.2	3.8
	20			1.6	2.2	1.0	4.8			1.7	1.2	1.2	4.1
	30			1.7	2.3	1.0	5.0			1.8	1.2	1.3	4.3
	40			1.8	2.4	1.1	5.3			1.9	1.3	1.3	4.5
40	10	17	9	2.0	2.9	1.5	6.4	12	9	2.1	1.5	1.6	5.1
	20			2.2	2.9	1.5	6.6			2.2	1.6	1.6	5.4
	30			2.3	3.0	1.5	6.9			2.4	1.6	1.7	5.7
	40			2.5	3.1	1.6	7.2			2.5	1.7	1.8	6.0
50	10	20	12	2.5	3.7	1.8	8.0	15	12	2.6	1.9	2.0	6.5
	20			2.7	3.7	1.9	8.2			2.8	2.0	2.1	6.8
	30			2.9	3.8	1.9	8.6			3.0	2.0	2.2	7.2
	40			3.1	3.9	2.0	9.0			3.2	2.1	2.3	7.6
75	10	25	17	3.8	5.5	2.9	12.2	20	17	3.8	2.8	3.0	9.7
	20			4.0	5.5	3.0	12.5			4.2	2.9	3.2	10.2
	30			4.3	5.7	3.1	13.1			4.5	3.1	3.3	10.8
	40			4.6	5.9	3.2	13.7			4.8	3.2	3.4	11.3
100	10	31	23	5.0	7.3	3.9	16.2	59	23	5.1	8.5	3.2	16.8
	20			5.4	7.3	4.0	16.7			5.5	8.7	3.4	17.6
	30			5.8	7.6	4.2	17.5			5.9	9.0	3.5	18.4
	40			6.1	7.8	4.3	18.3			6.4	9.2	3.5	19.2
125	10	36	28	6.3	9.1	5.0	20.4	64	28	6.4	10.6	4.0	21.0
	20			6.7	9.1	5.2	21.0			6.9	10.9	4.2	22.0
	30			7.2	9.5	5.4	22.0			7.4	11.2	4.3	23.0
	40			7.7	9.8	5.6	23.0			7.9	11.6	4.4	23.9
150	10	68	34	7.5	19.3	4.9	31.6	70	34	7.7	12.7	4.9	25.2
	20			8.1	19.3	5.1	32.4			8.3	13.1	5.1	26.5
	30			8.6	19.4	5.2	33.3			8.9	13.5	5.2	27.6
	40			9.2	19.9	5.3	34.4			9.5	13.9	5.3	28.7
175	10	80	40	8.8	22.5	5.7	36.9	76	40	9.0	14.8	7.0	30.8
	20			9.4	22.5	5.9	37.8			9.7	15.2	7.2	32.1
	30			10.1	22.7	6.1	38.8			10.4	15.7	7.4	33.5
	40			10.7	23.2	6.2	40.2			11.1	16.2	7.6	34.9
200	10	90	45	10.0	25.7	6.5	42.2	81	45	10.3	16.9	8.0	35.2
	20			10.8	25.7	6.8	43.3			11.1	17.4	8.2	36.7
	30			11.5	25.9	6.9	44.4			11.9	17.9	8.5	38.3
	40			12.3	26.5	7.1	45.9			12.7	18.5	8.7	39.9
250	10	112	56	12.5	32.1	8.1	52.7	92	56	12.8	21.1	10.0	44.0
	20			13.5	32.1	8.5	54.1			13.8	21.8	10.3	45.9
	30			14.4	32.4	8.7	55.5			14.9	22.4	10.6	47.9
	40			15.3	33.2	8.9	57.4			15.9	23.1	10.9	49.9
300	10	131	67	15.0	38.5	11.7	65.3	103	67	15.4	25.4	12.0	52.8
	20			16.2	38.5	12.1	66.8			16.6	26.1	12.4	55.1
	30			17.3	38.9	12.4	68.6			17.8	26.9	12.7	57.4
	40			18.4	39.8	12.8	70.9			19.1	27.7	13.0	59.9
350	10	143	79	17.5	45.0	13.7	76.2	115	79	18.0	29.6	16.0	63.6
	20			18.9	45.0	14.1	77.9			19.4	30.5	16.5	66.4
	30			20.2	45.4	14.5	80.0			20.8	31.4	17.0	69.2
	40			21.5	46.4	14.9	82.8			22.3	32.4	17.5	72.2
400	10	154	90	20.1	51.4	15.7	87.1	126	90	20.5	33.8	18.3	72.7
	20			21.5	51.4	16.1	89.0			22.2	34.8	18.9	75.9
	30			23.0	51.9	16.6	91.5			23.8	35.9	19.5	79.1
	40			24.5	53.1	17.0	94.6			25.4	37.0	20.0	82.5

## 60 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

		CYL. USED		SORTING TIME IN MINUTES						CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME			MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.3	.2	.2	.7	2	1			.3	.0	.2	.5
	20			.3	.2	.2	.7					.3	.0	.2	.5
	30			.3	.2	.2	.7					.3	.0	.3	.5
	40			.3	.2	.2	.7					.3	.0	.3	.5
10	10	4	3	.5	.4	.4	1.4	6	3			.6	.4	.4	1.4
	20			.6	.4	.4	1.4					.6	.4	.4	1.4
	30			.6	.4	.5	1.5					.6	.5	.4	1.5
	40			.6	.4	.5	1.5					.7	.5	.4	1.5
20	10	14	6	1.1	1.8	.8	3.6	9	6			1.1	.9	.8	2.8
	20			1.1	1.8	.8	3.7					1.1	.9	.9	2.9
	30			1.2	1.8	.8	3.8					1.2	.9	.9	3.0
	40			1.2	1.8	.8	3.8					1.3	1.0	.9	3.2
30	10	17	9	1.6	2.7	1.2	5.5	12	9			1.7	1.3	1.4	4.4
	20			1.7	2.7	1.3	5.7					1.7	1.3	1.4	4.5
	30			1.8	2.7	1.3	5.8					1.8	1.4	1.5	4.7
	40			1.9	2.7	1.4	5.9					2.0	1.4	1.5	4.9
40	10	19	11	2.2	3.6	1.6	7.4	14	11			2.2	1.8	1.9	5.9
	20			2.3	3.6	1.7	7.6					2.3	1.8	1.9	6.0
	30			2.4	3.6	1.8	7.7					2.5	1.8	2.0	6.3
	40			2.5	3.6	1.8	7.8					2.6	1.9	2.1	6.6
50	10	22	14	2.7	4.4	2.0	9.2	17	14			2.8	2.2	2.6	7.6
	20			2.8	4.5	2.2	9.4					2.9	2.2	2.6	7.7
	30			3.0	4.5	2.2	9.6					3.1	2.3	2.7	8.1
	40			3.1	4.5	2.3	9.8					3.3	2.4	2.8	8.5
75	10	29	21	4.1	6.7	3.4	14.1	57	21			4.2	7.7	2.9	14.8
	20			4.3	6.7	3.5	14.4					4.3	7.7	2.9	14.9
	30			4.5	6.7	3.6	14.7					4.6	7.8	2.9	15.3
	40			4.6	6.7	3.7	15.0					4.9	8.0	3.0	15.9
100	10	36	28	5.4	8.9	4.6	18.9	64	28			5.6	10.2	3.9	19.7
	20			5.7	8.9	4.7	19.3					5.7	10.2	3.9	19.9
	30			5.9	8.9	4.9	19.7					6.1	10.4	3.9	20.4
	40			6.2	8.9	5.0	20.1					6.5	10.6	4.1	21.2
125	10	68	34	6.8	19.6	4.9	31.3	70	34			7.0	12.8	4.9	24.7
	20			7.1	19.7	4.9	31.6					7.2	12.8	4.9	24.8
	30			7.4	19.7	4.9	32.0					7.7	12.9	4.9	25.5
	40			7.7	19.7	5.1	32.5					8.2	13.3	5.1	26.5
150	10	82	41	8.1	23.6	5.8	37.5	77	41			8.4	15.4	6.9	30.7
	20			8.5	23.6	5.9	38.0					8.6	15.4	7.3	31.2
	30			8.9	23.6	5.9	38.4					9.2	15.5	7.4	32.2
	40			9.3	23.6	6.1	39.0					9.8	15.9	7.6	33.3
175	10	96	48	9.5	27.5	6.8	43.8	84	48			9.8	17.9	8.1	35.8
	20			9.9	27.5	6.8	44.3					10.0	17.9	8.5	36.4
	30			10.4	27.5	6.9	44.8					10.7	18.1	8.7	37.5
	40			10.8	27.5	7.1	45.5					11.4	18.6	8.9	38.9
200	10	110	55	10.8	31.4	7.8	50.1	91	55			11.2	20.5	9.2	40.9
	20			11.4	31.5	7.8	50.6					11.5	20.5	9.7	41.6
	30			11.9	31.5	7.8	51.2					12.3	20.7	9.9	42.9
	40			12.4	31.5	8.1	51.9					13.1	21.2	10.1	44.4
250	10	132	68	13.6	39.3	11.2	64.0	104	68			14.0	25.6	11.6	51.1
	20			14.2	39.3	11.8	65.3					14.3	25.6	12.1	52.0
	30			14.8	39.3	12.0	66.2					15.3	25.9	12.4	53.6
	40			15.5	39.3	12.3	67.1					16.3	26.5	12.7	55.5
300	10	146	82	16.3	47.1	13.5	76.9	118	82			16.8	30.7	16.3	63.7
	20			17.0	47.2	14.1	78.3					17.2	30.7	16.7	64.6
	30			17.8	47.2	14.4	79.4					18.4	31.1	17.1	66.6
	40			18.6	47.2	14.8	80.5					19.6	31.8	17.6	69.0
350	10	160	96	19.0	55.0	15.7	89.7	132	96			19.6	35.8	19.0	74.4
	20			19.9	55.1	16.5	91.4					20.0	35.8	19.5	75.4
	30			20.8	55.1	16.9	92.7					21.5	36.2	20.0	77.7
	40			21.7	55.1	17.2	94.0					22.9	37.1	20.5	80.5
400	10	173	109	21.7	62.8	18.0	102.5	145	109			22.4	40.9	21.9	85.2
	20			22.7	62.9	18.8	104.4					22.9	40.9	22.5	86.4
	30			23.7	62.9	19.3	105.9					24.5	41.4	23.2	89.1
	40			24.8	62.9	19.7	107.4					26.1	42.4	23.8	92.4

## 70 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.3	.2	.2	.8	4	2	.3	.3	.2	.8
	20			.3	.2	.2	.8			.3	.3	.2	.8
	30			.3	.2	.2	.8			.3	.3	.2	.8
	40			.3	.2	.2	.8			.3	.3	.2	.8
10	10	5	4	.6	.5	.5	1.6	7	4	.6	.5	.5	1.6
	20			.6	.5	.5	1.6			.6	.5	.5	1.6
	30			.7	.5	.5	1.6			.7	.5	.5	1.6
	40			.7	.5	.5	1.7			.7	.5	.5	1.7
20	10	15	7	1.2	2.0	.9	4.2	10	7	1.2	1.0	1.0	3.3
	20			1.3	2.0	.9	4.2			1.3	1.0	1.1	3.4
	30			1.3	2.0	.9	4.3			1.3	1.0	1.1	3.4
	40			1.3	2.0	.9	4.3			1.4	1.0	1.1	3.5
30	10	18	10	1.9	3.1	1.4	6.3	13	10	1.9	1.5	1.6	4.9
	20			1.9	3.1	1.4	6.4			1.9	1.5	1.6	5.1
	30			2.0	3.1	1.5	6.5			2.0	1.5	1.7	5.2
	40			2.0	3.1	1.5	6.5			2.1	1.6	1.7	5.3
40	10	21	13	2.5	4.1	1.9	8.4	16	13	2.5	2.0	2.3	6.8
	20			2.5	4.1	1.9	8.5			2.6	2.0	2.4	7.0
	30			2.6	4.1	2.0	8.7			2.6	2.0	2.4	7.1
	40			2.6	4.1	2.0	8.7			2.7	2.1	2.5	7.3
50	10	24	16	3.1	5.1	2.4	10.5	19	16	3.1	2.5	2.9	8.5
	20			3.2	5.1	2.4	10.6			3.2	2.6	3.0	8.7
	30			3.3	5.1	2.4	10.8			3.3	2.6	3.0	8.9
	40			3.3	5.1	2.5	10.9			3.4	2.6	3.1	9.2
75	10	32	24	4.7	7.6	3.7	16.0	60	24	4.7	8.8	3.4	16.8
	20			4.8	7.7	3.9	16.3			4.8	8.8	3.4	17.0
	30			4.9	7.7	4.0	16.5			4.9	8.8	3.4	17.1
	40			4.9	7.7	4.1	16.7			5.1	8.9	3.4	17.4
100	10	40	32	6.2	10.2	5.1	21.5	68	32	6.2	11.7	4.5	22.5
	20			6.4	10.2	5.2	21.8			6.4	11.8	4.5	22.7
	30			6.5	10.2	5.4	22.2			6.6	11.8	4.5	22.8
	40			6.6	10.2	5.5	22.4			6.8	11.8	4.5	23.2
125	10	80	40	7.8	22.5	5.6	35.9	76	40	7.8	14.7	6.7	29.1
	20			8.0	22.6	5.6	36.2			8.0	14.7	6.7	29.4
	30			8.2	22.6	5.6	36.4			8.2	14.7	6.9	29.8
	40			8.2	22.6	5.7	36.5			8.6	14.8	7.0	30.3
150	10	94	47	9.3	27.1	6.7	43.1	83	47	9.3	17.6	8.0	34.9
	20			9.6	27.1	6.8	43.4			9.6	17.7	8.0	35.2
	30			9.8	27.1	6.8	43.7			9.8	17.7	8.2	35.7
	40			9.8	27.1	6.8	43.8			10.3	17.7	8.4	36.4
175	10	110	55	10.9	31.6	7.9	50.3	91	55	10.9	20.6	9.3	40.7
	20			11.2	31.6	7.9	50.6			11.2	20.6	9.3	41.1
	30			11.4	31.6	7.9	51.0			11.5	20.6	9.6	41.7
	40			11.5	31.6	7.9	51.0			12.0	20.7	9.8	42.5
200	10	126	63	12.4	36.1	9.0	57.5	99	63	12.4	23.5	10.6	46.6
	20			12.7	36.1	9.0	57.9			12.8	23.5	10.7	47.0
	30			13.1	36.2	9.0	58.3			13.1	23.5	11.0	47.6
	40			13.1	36.2	9.0	58.3			13.7	23.6	11.2	48.5
250	10	143	79	15.5	45.1	12.9	73.5	115	79	15.5	29.4	15.3	60.2
	20			15.9	45.1	13.0	74.0			16.0	29.4	15.9	61.3
	30			16.4	45.2	13.4	74.9			16.4	29.4	16.3	62.1
	40			16.4	45.2	13.6	75.3			17.1	29.5	16.6	63.3
300	10	158	94	18.6	54.1	15.5	88.2	130	94	18.6	35.2	18.4	72.3
	20			19.1	54.2	15.5	88.8			19.1	35.3	19.1	73.5
	30			19.6	54.2	16.0	89.9			19.7	35.3	19.5	74.5
	40			19.7	54.2	16.4	90.3			20.5	35.4	19.9	75.9
350	10	174	110	21.7	63.1	18.1	102.9	146	110	21.7	41.1	21.7	84.6
	20			22.3	63.2	18.1	103.6			22.3	41.2	22.3	85.8
	30			22.9	63.3	18.7	104.9			22.9	41.2	22.8	87.0
	40			23.0	63.3	19.1	105.4			24.0	41.3	23.4	88.7
400	10	189	125	24.8	72.1	20.7	117.6	161	125	24.8	47.0	24.8	96.6
	20			25.5	72.2	20.7	118.4			25.5	47.1	25.5	98.1
	30			26.2	72.3	21.4	119.9			26.2	47.1	26.1	99.4
	40			26.2	72.3	21.8	120.4			27.4	47.2	26.7	101.3

## 80 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.3	.3	.3	.9		4	2	.3	.3	.3	.9
	20			.4	.3	.3	.9				.4	.3	.3	.9
	30			.4	.3	.3	.9				.4	.3	.3	.9
	40			.4	.3	.3	.9				.4	.3	.3	.9
10	10	5	4	.7	.5	.5	1.8		7	4	.7	.6	.5	1.8
	20			.7	.5	.5	1.8				.7	.6	.5	1.8
	30			.7	.5	.6	1.8				.7	.6	.5	1.9
	40			.7	.5	.6	1.9				.7	.6	.5	1.9
20	10	16	6	1.4	2.3	1.0	4.7		11	8	1.4	1.2	1.1	3.7
	20			1.4	2.3	1.0	4.8				1.4	1.2	1.2	3.7
	30			1.4	2.3	1.0	4.8				1.4	1.2	1.2	3.8
	40			1.5	2.3	1.0	4.8				1.5	1.2	1.2	3.9
30	10	19	11	2.1	3.5	1.6	7.1		14	11	2.1	1.7	1.7	5.5
	20			2.1	3.5	1.6	7.2				2.1	1.7	1.8	5.6
	30			2.2	3.5	1.6	7.3				2.2	1.8	1.8	5.7
	40			2.2	3.5	1.6	7.3				2.2	1.8	1.9	5.8
40	10	23	15	2.7	4.6	2.1	9.5		18	15	2.7	2.3	2.5	7.6
	20			2.8	4.7	2.2	9.6				2.8	2.3	2.7	7.8
	30			2.9	4.7	2.2	9.7				2.9	2.3	2.7	7.9
	40			2.9	4.7	2.2	9.8				3.0	2.3	2.8	8.1
50	10	26	18	3.4	5.8	2.8	12.0		21	18	3.4	2.9	3.2	9.5
	20			3.5	5.8	2.8	12.1				3.5	2.9	3.3	9.7
	30			3.6	5.8	2.9	12.3				3.6	2.9	3.4	9.9
	40			3.7	5.8	3.0	12.5				3.7	2.9	3.5	10.1
75	10	35	27	5.1	8.7	4.2	18.1		63	27	5.1	10.1	3.8	19.0
	20			5.3	8.7	4.3	18.3				5.3	10.1	3.9	19.2
	30			5.4	8.7	4.5	18.6				5.4	10.1	3.9	19.3
	40			5.5	8.8	4.6	18.9				5.5	10.1	3.9	19.5
100	10	72	36	6.9	20.6	5.1	32.6		72	36	6.9	13.4	5.1	25.4
	20			7.0	20.6	5.1	32.8				7.0	13.4	5.1	25.6
	30			7.2	20.6	5.1	33.0				7.2	13.4	5.1	25.8
	40			7.4	20.7	5.2	33.2				7.4	13.4	5.2	26.0
125	10	90	45	8.6	25.7	6.4	40.7		81	45	8.6	16.8	7.6	32.9
	20			8.8	25.8	6.4	41.0				8.8	16.8	7.6	33.2
	30			9.0	25.8	6.4	41.2				9.0	16.8	7.6	33.4
	40			9.2	25.8	6.4	41.5				9.2	16.8	7.6	33.7
150	10	108	54	10.3	30.9	7.7	48.8		90	54	10.3	20.1	9.1	39.5
	20			10.5	30.9	7.7	49.1				10.5	20.1	9.1	39.8
	30			10.8	31.0	7.7	49.5				10.8	20.2	9.1	40.1
	40			11.0	31.0	7.7	49.8				11.1	20.2	9.2	40.4
175	10	126	63	12.0	36.0	9.0	57.0		99	63	12.0	23.5	10.6	46.1
	20			12.3	36.1	9.0	57.3				12.3	23.5	10.6	46.4
	30			12.6	36.1	9.0	57.7				12.6	23.5	10.7	46.8
	40			12.9	36.2	9.0	58.0				12.9	23.5	10.7	47.1
200	10	136	72	13.7	41.2	11.8	66.7		108	72	13.7	26.8	12.1	52.7
	20			14.0	41.2	11.8	67.1				14.1	26.9	12.2	53.1
	30			14.4	41.3	11.8	67.5				14.4	26.9	12.2	53.5
	40			14.7	41.3	11.9	67.9				14.8	26.9	12.2	53.9
250	10	154	90	17.1	51.5	14.7	83.3		126	90	17.1	33.5	17.5	68.2
	20			17.6	51.5	14.8	83.8				17.6	33.6	17.5	68.7
	30			18.0	51.6	14.8	84.4				18.0	33.6	18.0	69.7
	40			18.4	51.6	14.8	84.9				18.4	33.6	18.4	70.5
300	10	172	108	20.6	61.8	17.7	100.0		144	108	20.6	40.2	21.0	81.8
	20			21.1	61.8	17.7	100.6				21.1	40.3	21.1	82.4
	30			21.6	61.9	17.8	101.2				21.6	40.3	21.6	83.6
	40			22.1	62.0	17.8	101.8				22.1	40.3	22.1	84.6
350	10	189	125	24.0	72.1	20.6	116.7		161	125	24.0	46.9	24.5	95.4
	20			24.6	72.1	20.7	117.4				24.6	47.0	25.2	96.8
	30			25.2	72.2	20.7	118.1				25.2	47.1	25.7	98.0
	40			25.8	72.3	20.8	118.8				25.8	47.1	26.3	99.2
400	10	207	143	27.4	82.3	26.6	136.4		179	143	27.4	53.6	28.0	109.1
	20			28.1	82.4	26.7	137.2				28.1	53.7	28.7	110.6
	30			28.8	82.5	27.5	138.8				28.8	53.8	29.4	112.0
	40			29.4	82.6	28.0	140.1				29.5	53.8	30.0	113.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.4	.3	.3	1.0	6	3	.4	.3	.3	1.0
	20			.4	.3	.3	1.0			.4	.3	.3	1.0
	30			.4	.3	.3	1.0			.4	.3	.3	1.0
	40			.4	.3	.3	1.0			.4	.3	.3	1.0
10	10	13	5	.8	1.3	.6	2.6	8	5	.8	.7	.6	2.0
	20			.8	1.3	.6	2.7			.8	.7	.6	2.0
	30			.8	1.3	.6	2.7			.8	.7	.6	2.1
	40			.8	1.3	.6	2.7			.8	.7	.6	2.1
20	10	17	9	1.5	2.6	1.2	5.3	12	9	1.5	1.3	1.3	4.1
	20			1.5	2.6	1.2	5.4			1.5	1.3	1.3	4.1
	30			1.6	2.6	1.2	5.4			1.6	1.3	1.3	4.2
	40			1.6	2.6	1.2	5.5			1.6	1.3	1.3	4.2
30	10	21	13	2.3	3.9	1.8	8.0	16	13	2.3	2.0	2.1	6.4
	20			2.3	3.9	1.8	8.1			2.3	2.0	2.2	6.4
	30			2.4	3.9	1.8	8.1			2.4	2.0	2.2	6.5
	40			2.4	3.9	1.8	8.2			2.4	2.0	2.3	6.7
40	10	25	17	3.0	5.2	2.5	10.8	20	17	3.0	2.6	2.9	8.5
	20			3.1	5.2	2.5	10.8			3.1	2.6	2.9	8.6
	30			3.1	5.3	2.5	10.9			3.1	2.6	3.0	8.7
	40			3.2	5.3	2.5	11.0			3.2	2.6	3.0	8.9
50	10	29	21	3.8	6.5	3.2	13.4	57	21	3.8	7.6	2.9	14.2
	20			3.8	6.5	3.2	13.6			3.8	7.6	2.9	14.3
	30			3.9	6.6	3.2	13.7			3.9	7.6	2.9	14.4
	40			4.0	6.6	3.2	13.8			4.0	7.6	2.9	14.5
75	10	39	31	5.6	9.8	4.7	20.2	67	31	5.6	11.3	4.3	21.3
	20			5.8	9.8	4.8	20.3			5.8	11.4	4.3	21.5
	30			5.9	9.8	4.8	20.5			5.9	11.4	4.3	21.6
	40			6.0	9.9	5.0	20.9			6.0	11.4	4.3	21.8
100	10	82	41	7.5	23.2	5.8	36.5	77	41	7.5	15.1	6.8	29.5
	20			7.7	23.2	5.8	36.7			7.7	15.1	6.8	29.7
	30			7.9	23.3	5.8	36.9			7.9	15.2	6.9	29.9
	40			8.0	23.3	5.8	37.1			8.0	15.2	6.9	30.1
125	10	102	51	9.4	29.0	7.2	45.6	87	51	9.4	18.9	8.5	36.8
	20			9.6	29.1	7.2	45.9			9.6	18.9	8.6	37.1
	30			9.8	29.1	7.2	46.1			9.8	18.9	8.6	37.4
	40			10.0	29.1	7.2	46.4			10.0	19.0	8.6	37.6
150	10	122	61	11.3	34.8	8.6	54.8	97	61	11.3	22.7	10.3	44.2
	20			11.5	34.9	8.7	55.1			11.5	22.7	10.3	44.5
	30			11.8	34.9	8.7	55.4			11.8	22.7	10.3	44.8
	40			12.0	34.9	8.7	55.7			12.1	22.8	10.3	45.1
175	10	135	71	13.2	40.6	11.6	65.4	107	71	13.2	26.5	12.0	51.6
	20			13.5	40.7	11.6	65.8			13.5	26.5	12.0	51.9
	30			13.8	40.7	11.7	66.1			13.8	26.5	12.0	52.3
	40			14.1	40.8	11.7	66.5			14.1	26.6	12.0	52.7
200	10	145	81	15.0	46.4	13.3	74.8	117	81	15.0	30.2	15.8	61.1
	20			15.4	46.5	13.3	75.2			15.4	30.3	15.8	61.5
	30			15.7	46.5	13.3	75.6			15.7	30.3	15.9	61.9
	40			16.1	46.6	13.4	76.0			16.1	30.4	15.9	62.3
250	10	165	101	18.8	58.0	16.6	93.4	137	101	18.8	37.8	19.7	76.3
	20			19.2	58.1	16.6	94.0			19.2	37.8	19.8	76.8
	30			19.7	58.2	16.7	94.5			19.7	37.9	19.8	77.4
	40			20.1	58.2	16.7	95.0			20.1	38.0	19.9	77.9
300	10	185	121	22.6	69.7	19.9	112.1	157	121	22.6	45.3	23.7	91.6
	20			23.1	69.7	20.0	112.8			23.1	45.4	23.8	92.2
	30			23.6	69.8	20.0	113.4			23.6	45.5	23.8	92.9
	40			24.1	69.9	20.0	114.0			24.1	45.5	24.7	94.4
350	10	206	142	26.3	81.3	26.3	133.9	178	142	26.3	52.9	27.7	106.9
	20			26.9	81.4	26.3	134.6			26.9	53.0	27.7	107.6
	30			27.5	81.4	26.4	135.3			27.5	53.1	27.8	108.4
	40			28.1	81.5	26.4	136.0			28.1	53.1	28.9	110.1
400	10	226	162	30.1	92.9	30.0	153.0	198	162	30.1	60.5	40.0	130.5
	20			30.8	93.0	30.1	153.8			30.8	60.5	40.1	131.4
	30			31.4	93.1	30.1	154.6			31.4	60.6	41.2	133.3
	40			32.1	93.2	30.2	155.5			32.1	60.7	41.9	134.7

## 100 CHARACTER DATA RECORD

7010/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.3	.3	.3	1.0	6	3	.4	.4	.3	1.1
	20			.3	.3	.3	1.0			.4	.4	.3	1.1
	30			.3	.3	.3	1.0			.4	.4	.3	1.1
	40			.3	.3	.3	1.0			.4	.4	.3	1.1
10	10	13	5	.7	1.4	.6	2.8	8	5	.8	.7	.7	2.2
	20			.7	1.4	.6	2.8			.8	.7	.7	2.2
	30			.7	1.5	.6	2.8			.9	.7	.7	2.3
	40			.7	1.5	.6	2.8			.9	.7	.7	2.3
20	10	17	9	1.4	2.9	1.3	5.6	12	9	1.6	1.4	1.4	4.5
	20			1.4	2.9	1.3	5.6			1.7	1.4	1.4	4.6
	30			1.4	2.9	1.3	5.6			1.7	1.5	1.4	4.6
	40			1.4	2.9	1.3	5.6			1.7	1.5	1.4	4.6
30	10	22	14	2.1	4.3	2.0	8.4	17	14	2.4	2.2	2.4	7.0
	20			2.1	4.3	2.0	8.4			2.5	2.2	2.4	7.1
	30			2.1	4.4	2.0	8.4			2.6	2.2	2.4	7.1
	40			2.1	4.4	2.0	8.5			2.6	2.2	2.5	7.3
40	10	26	18	2.7	5.8	2.8	11.3	21	18	3.3	2.9	3.2	9.3
	20			2.8	5.8	2.8	11.3			3.3	2.9	3.2	9.4
	30			2.8	5.8	2.8	11.4			3.4	2.9	3.2	9.5
	40			2.8	5.8	2.8	11.4			3.5	2.9	3.3	9.7
50	10	31	23	3.4	7.2	3.5	14.1	59	23	4.1	8.4	3.2	15.6
	20			3.4	7.2	3.5	14.2			4.2	8.4	3.2	15.7
	30			3.5	7.3	3.5	14.2			4.3	8.4	3.2	15.8
	40			3.5	7.3	3.5	14.3			4.3	8.4	3.2	15.9
75	10	68	34	5.2	19.3	4.8	29.2	70	34	6.1	12.5	4.8	23.4
	20			5.2	19.3	4.8	29.3			6.3	12.6	4.8	23.6
	30			5.2	19.3	4.8	31.3			6.4	12.6	4.8	23.8
	40			5.2	19.3	4.8	29.3			6.5	12.6	4.8	23.9
100	10	90	45	6.9	25.7	6.4	38.9	81	45	8.2	16.7	7.6	32.4
	20			6.9	25.7	6.4	39.0			8.3	16.7	7.6	32.7
	30			6.9	25.7	6.4	39.1			8.5	16.8	7.6	32.9
	40			7.0	25.8	6.4	39.1			8.7	16.8	7.6	33.1
125	10	112	56	8.6	32.1	8.0	48.7	92	56	10.2	20.9	9.5	40.6
	20			8.6	32.1	8.0	48.8			10.4	20.9	9.5	40.8
	30			8.7	32.2	8.0	48.8			10.6	21.0	9.5	41.1
	40			8.7	32.2	8.0	48.9			10.8	21.0	9.5	41.3
150	10	131	67	10.3	38.5	11.0	59.9	103	67	12.2	25.1	11.3	48.7
	20			10.3	38.6	11.0	60.0			12.5	25.1	11.4	49.0
	30			10.4	38.6	11.1	60.1			12.8	25.1	11.4	49.3
	40			10.4	38.6	11.1	60.2			13.0	25.2	11.4	49.6
175	10	143	79	12.0	45.0	12.9	69.8	115	79	14.3	29.3	15.3	58.8
	20			12.1	45.0	12.9	69.9			14.6	29.3	15.3	59.2
	30			12.1	45.0	12.9	70.1			14.9	29.3	15.4	59.6
	40			12.2	45.1	12.9	70.2			15.2	29.4	15.4	59.9
200	10	154	90	13.7	51.4	14.7	79.8	126	90	16.3	33.4	17.5	67.2
	20			13.8	51.4	14.7	79.9			16.7	33.5	17.5	67.7
	30			13.9	51.5	14.7	80.1			17.0	33.5	17.5	68.1
	40			13.9	51.5	14.8	80.2			17.4	33.6	17.6	68.5
250	10	176	112	17.2	64.2	18.4	99.8	148	112	20.4	41.8	21.9	84.1
	20			17.2	64.3	18.4	99.9			20.8	41.9	21.9	84.6
	30			17.3	64.3	18.4	100.1			21.3	41.9	22.0	85.1
	40			17.4	64.4	18.5	100.3			21.7	42.0	22.0	85.7
300	10	198	134	20.6	77.1	24.9	122.6	170	134	24.5	50.2	26.2	100.9
	20			20.7	77.1	25.0	122.8			25.0	50.2	26.3	101.5
	30			20.8	77.2	25.0	123.0			25.5	50.3	26.3	102.1
	40			20.9	77.3	25.1	123.2			26.0	50.4	26.4	102.8
350	10	221	157	24.0	89.9	29.1	143.0	193	157	28.6	58.5	38.7	125.8
	20			24.1	90.0	29.1	143.2			29.2	58.6	38.8	126.6
	30			24.3	90.1	29.2	143.5			29.8	58.7	38.9	127.3
	40			24.4	90.2	29.2	143.8			30.4	58.7	39.9	129.0
400	10	243	179	27.5	102.8	33.2	163.4	215	179	32.6	66.9	44.3	143.8
	20			27.6	102.8	33.3	163.7			33.3	67.0	44.3	144.6
	30			27.7	102.9	33.3	164.0			34.0	67.0	44.4	145.5
	40			27.8	103.0	33.4	164.3			34.7	67.1	45.6	147.4

## 120 CHARACTER DATA RECORD

7010/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CCRE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.4	.4	.4	1.2	6	3	.5	.4	.4	1.3
	20			.4	.4	.4	1.2			.5	.4	.4	1.3
	30			.4	.4	.4	1.2			.5	.4	.4	1.3
	40			.4	.4	.4	1.2			.5	.4	.4	1.3
10	10	14	6	.8	1.8	.8	3.3	9	6	1.0	.9	.8	2.6
	20			.8	1.8	.8	3.4			1.0	.9	.8	2.7
	30			.8	1.8	.8	3.4			1.0	.9	.8	2.7
	40			.8	1.8	.8	3.4			1.0	.9	.8	2.7
20	10	19	11	1.6	3.5	1.6	6.8	14	11	1.9	1.8	1.7	5.4
	20			1.7	3.5	1.6	6.8			1.9	1.8	1.7	5.4
	30			1.7	3.5	1.6	6.8			2.0	1.8	1.7	5.5
	40			1.7	3.5	1.6	6.8			2.0	1.8	1.7	5.5
30	10	25	17	2.5	5.3	2.5	10.3	20	17	2.9	2.6	2.6	8.1
	20			2.5	5.3	2.5	10.3			2.9	2.6	2.6	8.2
	30			2.5	5.3	2.5	10.3			3.0	2.6	2.6	8.2
	40			2.5	5.3	2.5	10.3			3.0	2.6	2.6	8.3
40	10	30	22	3.3	7.0	3.4	13.7	58	22	3.8	8.1	3.1	15.0
	20			3.3	7.0	3.4	13.7			3.9	8.1	3.1	15.1
	30			3.3	7.0	3.4	13.7			3.9	8.1	3.1	15.2
	40			3.3	7.1	3.4	13.8			4.0	8.2	3.1	15.3
50	10	36	28	4.1	8.8	4.2	17.1	64	28	4.8	10.2	3.9	18.8
	20			4.1	8.8	4.2	17.1			4.8	10.2	3.9	18.9
	30			4.1	8.8	4.2	17.2			4.9	10.2	3.9	19.0
	40			4.2	8.8	4.2	17.2			5.0	10.2	3.9	19.1
60	10	66	33	4.9	18.7	4.6	28.3	69	33	5.7	12.2	4.6	22.5
	20			5.0	18.8	4.6	28.3			5.8	12.2	4.6	22.6
	30			5.0	18.8	4.6	28.4			5.9	12.2	4.6	22.8
	40			5.0	18.8	4.6	28.4			6.0	12.2	4.6	22.9
70	10	78	39	5.8	21.9	5.4	33.0	75	39	6.7	14.2	6.4	27.3
	20			5.8	21.9	5.4	33.1			6.8	14.2	6.4	27.4
	30			5.8	21.9	5.4	33.1			6.9	14.3	6.4	27.6
	40			5.8	21.9	5.4	33.2			7.0	14.3	6.4	27.7
80	10	88	44	6.6	25.0	6.2	37.7	80	44	7.6	16.3	7.3	31.2
	20			6.6	25.0	6.2	37.8			7.8	16.3	7.3	31.4
	30			6.6	25.0	6.2	37.8			7.9	16.3	7.3	31.5
	40			6.7	25.0	6.2	37.9			8.0	16.3	7.4	31.7
90	10	98	49	7.4	28.1	6.9	42.4	85	49	8.6	18.3	8.2	35.1
	20			7.4	28.1	6.9	42.5			8.7	18.3	8.3	35.3
	30			7.5	28.2	6.9	42.6			8.9	18.3	8.3	35.5
	40			7.5	28.2	7.0	42.6			9.0	18.3	8.3	35.7
100	10	110	55	8.2	31.2	7.7	47.2	91	55	9.5	20.3	9.2	39.0
	20			8.3	31.3	7.7	47.2			9.7	20.3	9.2	39.2
	30			8.3	31.3	7.7	47.3			9.9	20.4	9.2	39.4
	40			8.3	31.3	7.7	47.4			10.0	20.4	9.2	39.6
120	10	130	66	9.9	37.5	10.7	58.0	102	66	11.4	24.4	11.0	46.8
	20			9.9	37.5	10.7	58.1			11.6	24.4	11.0	47.1
	30			10.0	37.5	10.7	58.2			11.8	24.4	11.0	47.3
	40			10.0	37.6	10.7	58.3			12.0	24.5	11.0	47.5
140	10	141	77	11.5	43.7	12.4	67.7	113	77	13.3	28.4	14.9	56.6
	20			11.6	43.8	12.5	67.8			13.6	28.5	14.9	56.9
	30			11.6	43.8	12.5	67.9			13.8	28.5	14.9	57.2
	40			11.7	43.8	12.5	68.0			14.1	28.5	14.9	57.5
160	10	151	87	13.2	50.0	14.2	77.4	123	87	15.2	32.5	17.0	64.7
	20			13.2	50.0	14.2	77.5			15.5	32.5	17.0	65.1
	30			13.3	50.0	14.3	77.6			15.8	32.6	17.0	65.4
	40			13.3	50.1	14.3	77.7			16.1	32.6	17.1	65.7
180	10	162	98	14.8	56.2	16.0	87.0	134	98	17.2	36.6	19.1	72.8
	20			14.9	56.3	16.0	87.2			17.5	36.6	19.1	73.2
	30			14.9	56.3	16.0	87.3			17.8	36.7	19.2	73.6
	40			15.0	56.3	16.1	87.4			18.1	36.7	19.2	74.0
200	10	173	109	16.5	62.5	17.8	96.7	145	109	19.1	40.6	21.2	80.9
	20			16.5	62.5	17.8	96.8			19.4	40.7	21.3	81.4
	30			16.6	62.6	17.8	97.0			19.7	40.7	21.3	81.8
	40			16.6	62.6	17.9	97.1			20.1	40.8	21.3	82.2



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	.5	.5	.5	1.4	7	4	.5	.5	.5	1.5
	20			.5	.5	.5	1.4			.5	.5	.5	1.5
	30			.5	.5	.5	1.4			.6	.5	.5	1.5
	40			.5	.5	.5	1.4			.6	.5	.5	1.5
10	10	15	7	.9	2.0	.9	3.9	10	7	1.1	1.0	1.0	3.1
	20			1.0	2.0	.9	3.9			1.1	1.0	1.0	3.1
	30			1.0	2.0	.9	3.9			1.1	1.0	1.0	3.1
	40			1.0	2.0	.9	3.9			1.1	1.0	1.0	3.1
20	10	21	13	1.9	4.0	1.9	7.8	16	13	2.2	2.0	2.2	6.4
	20			1.9	4.0	1.9	7.8			2.2	2.0	2.2	6.4
	30			1.9	4.0	1.9	7.8			2.2	2.0	2.2	6.5
	40			1.9	4.0	1.9	7.8			2.3	2.0	2.2	6.5
30	10	27	19	2.8	6.0	2.9	11.8	55	19	3.2	7.0	2.7	12.9
	20			2.9	6.1	2.9	11.8			3.3	7.0	2.7	13.0
	30			2.9	6.1	2.9	11.8			3.3	7.0	2.7	13.0
	40			2.9	6.1	2.9	11.9			3.4	7.0	2.7	13.1
40	10	33	25	3.8	8.1	3.9	15.7	61	25	4.3	9.3	3.6	17.2
	20			3.8	8.1	3.9	15.8			4.4	9.3	3.6	17.3
	30			3.8	8.1	3.9	15.8			4.4	9.4	3.6	17.4
	40			3.8	8.1	3.9	15.8			4.5	9.4	3.6	17.5
50	10	40	32	4.7	10.1	4.9	19.7	68	32	5.4	11.7	4.4	21.5
	20			4.8	10.1	4.9	19.7			5.5	11.7	4.5	21.6
	30			4.8	10.1	4.9	19.8			5.6	11.7	4.5	21.7
	40			4.8	10.1	4.9	19.8			5.6	11.7	4.5	21.8
60	10	76	38	5.7	21.5	5.3	32.6	74	38	6.5	14.0	6.3	26.8
	20			5.7	21.5	5.3	32.6			6.6	14.0	6.3	26.9
	30			5.7	21.6	5.4	32.6			6.7	14.0	6.3	27.1
	40			5.7	21.6	5.4	32.7			6.8	14.0	6.4	27.2
70	10	88	44	6.6	25.1	6.2	38.0	80	44	7.5	16.3	7.4	31.3
	20			6.7	25.1	6.2	38.0			7.7	16.4	7.4	31.4
	30			6.7	25.2	6.2	38.1			7.8	16.4	7.4	31.6
	40			6.7	25.2	6.2	38.1			7.9	16.4	7.4	31.7
80	10	100	50	7.6	28.7	7.1	43.4	86	50	8.6	18.7	8.4	35.7
	20			7.6	28.7	7.1	43.5			8.8	18.7	8.5	35.9
	30			7.6	28.7	7.1	43.5			8.9	18.7	8.5	36.1
	40			7.6	28.8	7.1	43.6			9.0	18.7	8.5	36.2
90	10	114	57	8.5	32.3	8.0	48.8	93	57	9.7	21.0	9.5	40.2
	20			8.6	32.3	8.0	48.9			9.9	21.0	9.5	40.4
	30			8.6	32.3	8.0	48.9			10.0	21.1	9.5	40.6
	40			8.6	32.4	8.0	49.0			10.2	21.1	9.5	40.8
100	10	126	63	9.5	35.9	8.9	54.3	99	63	10.8	23.3	10.6	44.7
	20			9.5	35.9	8.9	54.3			10.9	23.4	10.6	44.9
	30			9.5	35.9	8.9	54.4			11.1	23.4	10.6	45.1
	40			9.6	36.0	8.9	54.5			11.3	23.4	10.6	45.3
120	10	139	75	11.4	43.1	12.3	66.7	111	75	12.9	28.0	14.7	55.6
	20			11.4	43.1	12.3	66.8			13.1	28.0	14.7	55.8
	30			11.4	43.1	12.3	66.9			13.3	28.1	14.7	56.1
	40			11.5	43.2	12.3	67.0			13.5	28.1	14.7	56.4
140	10	152	88	13.3	50.2	14.3	77.8	124	88	15.1	32.7	17.1	64.9
	20			13.3	50.3	14.4	77.9			15.3	32.7	17.1	65.2
	30			13.3	50.3	14.4	78.0			15.6	32.7	17.1	65.4
	40			13.4	50.3	14.4	78.1			15.8	32.8	17.2	65.7
160	10	164	100	15.2	57.4	16.4	89.0	136	100	17.2	37.4	19.5	74.1
	20			15.2	57.5	16.4	89.1			17.5	37.4	19.6	74.5
	30			15.3	57.5	16.4	89.2			17.8	37.4	19.6	74.8
	40			15.3	57.5	16.5	89.3			18.1	37.5	19.6	75.1
180	10	177	113	17.1	64.6	18.4	100.1	149	113	19.4	42.0	22.0	83.4
	20			17.1	64.6	18.5	100.2			19.7	42.1	22.0	83.8
	30			17.2	64.7	18.5	100.3			20.0	42.1	22.1	84.2
	40			17.2	64.7	18.5	100.5			20.3	42.1	22.1	84.6
200	10	189	125	18.9	71.8	20.5	111.2	161	125	21.5	46.7	24.4	92.7
	20			19.0	71.8	20.5	111.3			21.9	46.7	24.5	93.1
	30			19.1	71.9	20.5	111.5			22.2	46.8	24.5	93.5
	40			19.1	71.9	20.6	111.6			22.6	46.8	24.6	93.9

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	5	4	.5	.5	.5	1.6		7	4	.6	.6	.5	1.8
	20			.5	.5	.5	1.6				.6	.6	.5	1.8
	30			.6	.5	.5	1.6				.6	.6	.6	1.8
	40			.6	.5	.5	1.6				.6	.6	.6	1.8
10	10	16	8	1.1	2.4	1.0	4.5		11	8	1.2	1.2	1.2	3.6
	20			1.1	2.4	1.0	4.5				1.2	1.2	1.2	3.6
	30			1.1	2.4	1.0	4.5				1.3	1.2	1.2	3.6
	40			1.1	2.4	1.0	4.5				1.3	1.2	1.2	3.6
20	10	23	15	2.2	4.7	2.2	9.1		18	15	2.5	2.4	2.6	7.4
	20			2.2	4.7	2.2	9.1				2.5	2.4	2.6	7.4
	30			2.2	4.7	2.2	9.1				2.5	2.4	2.6	7.5
	40			2.2	4.7	2.2	9.1				2.6	2.4	2.6	7.5
30	10	31	23	3.3	7.1	3.4	13.8		59	23	3.7	8.2	3.1	15.0
	20			3.3	7.1	3.4	13.8				3.7	8.2	3.1	15.1
	30			3.3	7.1	3.4	13.8				3.8	8.2	3.1	15.1
	40			3.3	7.1	3.4	13.8				3.8	8.3	3.1	15.2
40	10	38	30	4.4	9.5	4.5	18.4		66	30	4.9	11.0	4.1	20.0
	20			4.4	9.5	4.5	18.4				5.0	11.0	4.1	20.1
	30			4.4	9.5	4.5	18.4				5.0	11.0	4.1	20.2
	40			4.4	9.5	4.6	18.5				5.1	11.0	4.1	20.2
50	10	74	37	5.5	21.1	5.2	31.7		73	37	6.1	13.7	6.2	26.0
	20			5.5	21.1	5.2	31.8				6.2	13.7	6.2	26.1
	30			5.5	21.1	5.2	31.8				6.3	13.7	6.2	26.2
	40			5.5	21.1	5.2	31.8				6.4	13.8	6.2	26.3
60	10	90	45	6.6	25.3	6.2	38.1		81	45	7.4	16.5	7.4	31.2
	20			6.6	25.3	6.2	38.1				7.5	16.5	7.4	31.3
	30			6.6	25.3	6.2	38.1				7.6	16.5	7.4	31.4
	40			6.6	25.4	6.2	38.2				7.7	16.5	7.4	31.6
70	10	104	52	7.7	29.5	7.2	44.4		88	52	8.6	19.2	8.6	36.4
	20			7.7	29.5	7.2	44.5				8.7	19.2	8.6	36.5
	30			7.7	29.6	7.2	44.5				8.8	19.2	8.6	36.7
	40			7.7	29.6	7.2	44.6				8.9	19.3	8.7	36.8
80	10	118	59	8.8	33.7	8.3	50.8		95	59	9.8	21.9	9.9	41.6
	20			8.8	33.8	8.3	50.8				9.9	22.0	9.9	41.8
	30			8.8	33.8	8.3	50.9				10.1	22.0	9.9	41.9
	40			8.8	33.8	8.3	50.9				10.2	22.0	9.9	42.1
90	10	131	67	9.9	38.0	10.7	58.6		103	67	11.0	24.7	11.1	46.8
	20			9.9	38.0	10.8	58.6				11.2	24.7	11.1	47.0
	30			9.9	38.0	10.8	58.7				11.3	24.7	11.1	47.2
	40			9.9	38.0	10.8	58.8				11.5	24.8	11.1	47.4
100	10	138	74	11.0	42.2	11.9	65.1		110	74	12.3	27.4	14.3	54.0
	20			11.0	42.2	12.0	65.1				12.4	27.5	14.3	54.2
	30			11.0	42.2	12.0	65.2				12.6	27.5	14.4	54.4
	40			11.0	42.3	12.0	65.3				12.8	27.5	14.4	54.6
120	10	153	89	13.1	50.6	14.3	78.1		125	89	14.7	32.9	17.2	64.8
	20			13.2	50.6	14.3	78.2				14.9	32.9	17.2	65.1
	30			13.2	50.7	14.4	78.3				15.1	33.0	17.2	65.3
	40			13.2	50.7	14.4	78.3				15.3	33.0	17.2	65.6
140	10	167	103	15.3	59.0	16.7	91.1		139	103	17.2	38.4	20.0	75.6
	20			15.4	59.1	16.7	91.2				17.4	38.4	20.1	75.9
	30			15.4	59.1	16.8	91.3				17.6	38.5	20.1	76.2
	40			15.5	59.2	16.8	91.4				17.9	38.5	20.1	76.5
160	10	182	118	17.5	67.5	19.1	104.1		154	118	19.6	43.9	22.9	86.4
	20			17.6	67.5	19.1	104.2				19.9	43.9	23.0	86.8
	30			17.6	67.6	19.2	104.3				20.1	44.0	23.0	87.1
	40			17.7	67.6	19.2	104.4				20.4	44.0	23.0	87.4
180	10	197	133	19.7	75.9	24.4	120.1		169	133	22.1	49.4	25.8	97.2
	20			19.8	76.0	24.5	120.2				22.4	49.4	25.8	97.6
	30			19.8	76.0	24.5	120.3				22.7	49.5	25.9	98.0
	40			19.9	76.1	24.5	120.5				23.0	49.5	25.9	98.4
200	10	212	148	21.9	84.3	27.1	133.4		184	148	24.5	54.9	36.6	116.0
	20			22.0	84.4	27.2	133.5				24.8	54.9	36.7	116.4
	30			22.0	84.5	27.2	133.7				25.2	55.0	36.7	116.8
	40			22.1	84.5	27.2	133.8				25.5	55.0	36.7	117.3

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CH LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	.6	1.3	.6	2.5	8	5	.7	.7	.6	2.0
	20			.6	1.3	.6	2.5			.7	.7	.6	2.0
	30			.6	1.3	.6	2.5			.7	.7	.6	2.0
	40			.6	1.3	.6	2.5			.7	.7	.6	2.0
10	10	17	9	1.2	2.7	1.2	5.1	12	9	1.4	1.3	1.3	4.0
	20			1.2	2.7	1.2	5.1			1.4	1.3	1.3	4.0
	30			1.2	2.7	1.2	5.1			1.4	1.3	1.3	4.1
	40			1.2	2.7	1.2	5.2			1.4	1.3	1.3	4.1
20	10	25	17	2.5	5.4	2.6	10.4	20	17	2.7	2.7	2.6	8.0
	20			2.5	5.4	2.6	10.4			2.8	2.7	2.6	8.1
	30			2.5	5.4	2.6	10.4			2.8	2.7	2.6	8.1
	40			2.5	5.4	2.6	10.4			2.8	2.7	2.6	8.2
30	10	33	25	3.7	8.0	3.8	15.6	61	25	4.1	9.3	3.5	16.9
	20			3.7	8.0	3.8	15.6			4.1	9.3	3.5	17.0
	30			3.7	8.1	3.8	15.6			4.2	9.3	3.5	17.0
	40			3.7	8.1	3.9	15.6			4.2	9.3	3.5	17.1
40	10	68	34	4.9	19.1	4.7	28.7	70	34	5.5	12.4	4.7	22.5
	20			4.9	19.1	4.7	28.7			5.5	12.4	4.7	22.6
	30			5.0	19.1	4.7	28.8			5.6	12.4	4.7	22.7
	40			5.0	19.1	4.7	28.8			5.7	12.5	4.7	22.8
50	10	84	42	6.2	23.9	5.8	35.9	78	42	6.8	15.5	7.0	29.3
	20			6.2	23.9	5.8	35.9			6.9	15.5	7.0	29.4
	30			6.2	23.9	5.8	35.9			7.0	15.6	7.0	29.5
	40			6.2	23.9	5.8	36.0			7.1	15.6	7.0	29.6
60	10	100	50	7.4	28.7	7.0	43.1	86	50	8.2	18.6	8.4	35.2
	20			7.4	28.7	7.0	43.1			8.3	18.7	8.4	35.3
	30			7.4	28.7	7.0	43.1			8.4	18.7	8.4	35.4
	40			7.5	28.7	7.0	43.2			8.5	18.7	8.4	35.5
70	10	118	59	8.6	33.4	8.2	50.2	95	59	9.5	21.7	9.7	41.0
	20			8.7	33.5	8.2	50.3			9.7	21.8	9.8	41.2
	30			8.7	33.5	8.2	50.3			9.8	21.8	9.8	41.3
	40			8.7	33.5	8.2	50.4			9.9	21.8	9.8	41.5
80	10	131	67	9.9	38.2	10.8	58.9	103	67	10.9	24.9	11.1	46.9
	20			9.9	38.2	10.8	58.9			11.0	24.9	11.1	47.1
	30			9.9	38.3	10.8	59.0			11.2	24.9	11.2	47.2
	40			9.9	38.3	10.8	59.0			11.3	24.9	11.2	47.4
90	10	139	75	11.1	43.0	12.1	66.2	111	75	12.3	28.0	14.6	54.8
	20			11.1	43.0	12.2	66.3			12.4	28.0	14.6	55.0
	30			11.2	43.0	12.2	66.4			12.6	28.0	14.6	55.2
	40			11.2	43.1	12.2	66.4			12.7	28.0	14.6	55.4
100	10	148	84	12.3	47.8	13.5	73.6	120	84	13.6	31.1	16.2	60.9
	20			12.4	47.8	13.5	73.7			13.8	31.1	16.2	61.1
	30			12.4	47.8	13.5	73.7			14.0	31.1	16.2	61.3
	40			12.4	47.8	13.5	73.8			14.1	31.1	16.3	61.5
120	10	164	100	14.8	57.3	16.2	88.3	136	100	16.4	37.3	19.4	73.1
	20			14.8	57.4	16.2	88.4			16.6	37.3	19.5	73.3
	30			14.9	57.4	16.2	88.5			16.8	37.3	19.5	73.6
	40			14.9	57.4	16.2	88.6			17.0	37.4	19.5	73.9
140	10	181	117	17.3	66.9	18.9	103.0	153	117	19.1	43.5	22.7	85.3
	20			17.3	66.9	18.9	103.1			19.3	43.5	22.7	85.6
	30			17.3	66.9	18.9	103.2			19.6	43.6	22.8	85.9
	40			17.4	67.0	19.0	103.3			19.8	43.6	22.8	86.2
160	10	198	134	19.7	76.4	24.6	120.7	170	134	21.8	49.7	26.0	97.5
	20			19.8	76.5	24.6	120.8			22.1	49.7	26.0	97.8
	30			19.8	76.5	24.6	121.0			22.4	49.8	26.0	98.2
	40			19.9	76.6	24.7	121.1			22.6	49.8	26.0	98.5
180	10	214	150	22.2	86.0	27.6	135.8	186	150	24.6	55.9	37.4	117.8
	20			22.3	86.0	27.7	136.0			24.9	56.0	37.4	118.2
	30			22.3	86.1	27.7	136.1			25.2	56.0	37.5	118.6
	40			22.4	86.1	27.7	136.2			25.5	56.0	37.5	119.0
200	10	231	167	24.7	95.5	30.7	150.9	203	167	27.3	62.1	41.5	130.9
	20			24.7	95.6	30.7	151.1			27.6	62.2	41.6	131.4
	30			24.8	95.6	30.8	151.2			28.0	62.2	41.6	131.8
	40			24.8	95.7	30.8	151.3			28.3	62.3	41.7	132.2

## 200 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	.7	1.4	.6	2.7	8	5	.7	.7	.7	2.1
	20			.7	1.4	.6	2.7			.7	.7	.7	2.1
	30			.7	1.4	.6	2.7			.7	.7	.7	2.1
	40			.7	1.4	.6	2.7			.7	.7	.7	2.1
10	10	17	9	1.3	2.9	1.3	5.5	12	9	1.3	1.4	1.4	4.2
	20			1.3	2.9	1.3	5.5			1.3	1.4	1.4	4.2
	30			1.3	2.9	1.3	5.5			1.3	1.4	1.4	4.2
	40			1.3	2.9	1.3	5.6			1.3	1.4	1.4	4.2
20	10	26	18	2.7	5.7	2.8	11.2	21	18	2.7	2.9	2.8	8.4
	20			2.7	5.7	2.8	11.2			2.7	2.9	2.8	8.4
	30			2.7	5.7	2.8	11.2			2.7	2.9	2.8	8.4
	40			2.7	5.8	2.8	11.2			2.7	2.9	2.9	8.4
30	10	35	27	4.0	8.6	4.2	16.8	63	27	4.0	10.0	3.8	17.8
	20			4.0	8.6	4.2	16.8			4.0	10.0	3.8	17.8
	30			4.0	8.6	4.2	16.8			4.0	10.0	3.8	17.8
	40			4.0	8.6	4.2	16.8			4.0	10.0	3.8	17.9
40	10	72	36	5.4	20.5	5.1	30.9	72	36	5.4	13.3	5.1	23.7
	20			5.4	20.5	5.1	30.9			5.4	13.3	5.1	23.8
	30			5.4	20.5	5.1	30.9			5.4	13.3	5.1	23.8
	40			5.4	20.5	5.1	31.0			5.4	13.3	5.1	23.8
50	10	90	45	6.7	25.6	6.3	38.6	81	45	6.7	16.6	7.5	30.9
	20			6.7	25.6	6.3	38.7			6.7	16.7	7.5	30.9
	30			6.7	25.6	6.3	38.7			6.7	16.7	7.5	30.9
	40			6.7	25.6	6.4	= .7			6.7	16.7	7.5	31.0
60	10	108	54	8.0	30.7	7.6	46.3	90	54	8.0	20.0	9.0	37.0
	20			8.1	30.7	7.6	46.4			8.1	20.0	9.0	37.1
	30			8.1	30.7	7.6	46.4			8.1	20.0	9.0	37.1
	40			8.1	30.8	7.6	46.5			8.1	20.0	9.0	37.2
70	10	126	63	9.4	35.8	8.9	54.1	99	63	9.4	23.3	10.5	43.2
	20			9.4	35.8	8.9	54.1			9.4	23.3	10.5	43.2
	30			9.4	35.9	8.9	54.2			9.4	23.3	10.5	43.3
	40			9.4	35.9	8.9	54.2			9.4	23.3	10.6	43.3
80	10	136	72	10.7	40.9	11.7	63.3	108	72	10.7	26.6	12.0	49.4
	20			10.7	41.0	11.7	63.4			10.7	26.6	12.0	49.4
	30			10.8	41.0	11.7	63.4			10.8	26.7	12.1	49.5
	40			10.8	41.0	11.7	63.5			10.8	26.7	12.1	49.5
90	10	145	81	12.1	46.0	13.1	71.2	117	81	12.1	29.9	15.7	57.7
	20			12.1	46.1	13.1	71.3			12.1	30.0	15.7	57.7
	30			12.1	46.1	13.2	71.4			12.1	30.0	15.7	57.8
	40			12.1	46.1	13.2	71.4			12.1	30.0	15.7	57.9
100	10	154	90	13.4	51.2	14.6	79.2	126	90	13.4	33.3	17.4	64.1
	20			13.4	51.2	14.6	79.2			13.4	33.3	17.4	64.2
	30			13.5	51.2	14.6	79.3			13.5	33.3	17.4	64.2
	40			13.5	51.3	14.6	79.4			13.5	33.3	17.5	64.3
120	10	172	108	16.1	61.4	17.5	95.0	144	108	16.1	39.9	20.9	76.9
	20			16.1	61.4	17.5	95.1			16.1	40.0	20.9	77.0
	30			16.1	61.5	17.5	95.2			16.2	40.0	20.9	77.1
	40			16.2	61.5	17.6	95.2			16.2	40.0	21.0	77.2
140	10	189	125	18.8	71.6	20.4	110.8	161	125	18.8	46.6	24.4	89.7
	20			18.8	71.7	20.4	110.9			18.8	46.6	24.4	89.9
	30			18.8	71.7	20.5	111.0			18.8	46.7	24.5	90.0
	40			18.9	71.8	20.5	111.1			18.9	46.7	24.5	90.1
160	10	207	143	21.4	81.9	26.4	129.7	179	143	21.4	53.2	27.9	102.6
	20			21.5	81.9	26.5	129.9			21.5	53.3	27.9	102.7
	30			21.5	82.0	26.5	130.0			21.5	53.3	27.9	102.8
	40			21.6	82.0	26.5	130.1			21.6	53.4	28.0	102.9
180	10	225	161	24.1	92.1	29.7	146.0	197	161	24.1	59.9	39.9	123.9
	20			24.2	92.1	29.8	146.1			24.2	59.9	39.9	124.0
	30			24.2	92.2	29.8	146.2			24.2	60.0	40.0	124.2
	40			24.3	92.3	29.8	146.3			24.3	60.0	40.0	124.3
200	10	243	179	26.8	102.3	33.0	162.2	215	179	26.8	66.6	44.3	137.7
	20			26.9	102.4	33.1	162.3			26.9	66.6	44.4	137.8
	30			26.9	102.4	33.1	162.5			26.9	66.6	44.4	138.0
	40			27.0	102.5	33.2	162.6			27.0	66.7	44.4	138.1

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	.8	1.7	.7	3.2	9	6	.8	.8	.8	2.4
	20			.8	1.7	.7	3.2			.8	.8	.8	2.4
	30			.8	1.7	.7	3.2			.8	.8	.8	2.4
	40			.8	1.7	.7	3.2			.8	.8	.8	2.4
10	10	19	11	1.5	3.3	1.5	6.4	14	11	1.5	1.7	1.6	4.8
	20			1.5	3.3	1.5	6.4			1.5	1.7	1.6	4.8
	30			1.5	3.3	1.5	6.4			1.5	1.7	1.6	4.8
	40			1.5	3.3	1.5	6.4			1.5	1.7	1.6	4.8
15	10	24	16	2.3	5.0	2.3	9.6	19	16	2.3	2.5	2.4	7.2
	20			2.3	5.0	2.3	9.6			2.3	2.5	2.4	7.2
	30			2.3	5.0	2.3	9.6			2.3	2.5	2.4	7.2
	40			2.3	5.0	2.3	9.6			2.3	2.5	2.5	7.3
20	10	29	21	3.0	6.7	3.2	12.9	57	21	3.0	7.8	2.9	13.7
	20			3.0	6.7	3.2	12.9			3.0	7.8	2.9	13.7
	30			3.1	6.7	3.2	12.9			3.1	7.8	2.9	13.7
	40			3.1	6.7	3.2	12.9			3.1	7.8	2.9	13.7
25	10	35	27	3.8	8.4	4.0	16.1	63	27	3.8	9.7	3.6	17.1
	20			3.8	8.4	4.0	16.1			3.8	9.7	3.6	17.1
	30			3.8	8.4	4.0	16.2			3.8	9.7	3.6	17.1
	40			3.8	8.4	4.0	16.2			3.8	9.7	3.6	17.1
30	10	40	32	4.6	10.0	4.8	19.3	68	32	4.6	11.6	4.3	20.5
	20			4.6	10.0	4.8	19.4			4.6	11.6	4.3	20.5
	30			4.6	10.0	4.8	19.4			4.6	11.6	4.3	20.6
	40			4.6	10.0	4.8	19.4			4.6	11.7	4.3	20.6
35	10	74	37	5.3	20.9	5.0	31.2	73	37	5.3	13.6	6.0	24.9
	20			5.3	20.9	5.0	31.3			5.3	13.6	6.1	25.0
	30			5.3	20.9	5.0	31.3			5.3	13.6	6.1	25.0
	40			5.4	20.9	5.1	31.3			5.4	13.6	6.1	25.0
40	10	84	42	6.1	23.9	5.8	35.7	78	42	6.1	15.5	6.9	28.5
	20			6.1	23.9	5.8	35.7			6.1	15.5	6.9	28.5
	30			6.1	23.9	5.8	35.7			6.1	15.5	6.9	28.6
	40			6.1	23.9	5.8	35.8			6.1	15.5	6.9	28.6
45	10	94	47	6.8	26.8	6.5	40.2	83	47	6.8	17.5	7.8	32.1
	20			6.9	26.8	6.5	40.2			6.9	17.5	7.8	32.1
	30			6.9	26.9	6.5	40.2			6.9	17.5	7.8	32.1
	40			6.9	26.9	6.5	40.2			6.9	17.5	7.8	32.2
50	10	106	53	7.6	29.8	7.2	44.6	89	53	7.6	19.4	8.6	35.6
	20			7.6	29.8	7.2	44.7			7.6	19.4	8.7	35.7
	30			7.6	29.8	7.2	44.7			7.6	19.4	8.7	35.7
	40			7.6	29.9	7.2	44.7			7.6	19.4	8.7	35.7
55	10	116	58	8.4	32.8	7.9	49.1	94	58	8.4	21.3	9.5	39.2
	20			8.4	32.8	7.9	49.1			8.4	21.3	9.5	39.2
	30			8.4	32.8	7.9	49.2			8.4	21.4	9.5	39.3
	40			8.4	32.8	7.9	49.2			8.4	21.4	9.5	39.3
60	10	126	63	9.1	35.8	8.6	53.5	99	63	9.1	23.3	10.4	42.8
	20			9.1	35.8	8.6	53.6			9.1	23.3	10.4	42.8
	30			9.2	35.8	8.7	53.6			9.2	23.3	10.4	42.8
	40			9.2	35.8	8.7	53.7			9.2	23.3	10.4	42.9
70	10	137	73	10.6	41.7	11.7	64.1	109	73	10.6	27.1	14.1	51.9
	20			10.7	41.8	11.7	64.2			10.7	27.2	14.2	52.0
	30			10.7	41.8	11.7	64.2			10.7	27.2	14.2	52.0
	40			10.7	41.8	11.8	64.3			10.7	27.2	14.2	52.1
80	10	148	84	12.2	47.7	13.4	73.3	120	84	12.2	31.0	16.2	59.3
	20			12.2	47.7	13.4	73.3			12.2	31.0	16.2	59.4
	30			12.2	47.8	13.4	73.4			12.2	31.1	16.2	59.5
	40			12.2	47.8	13.4	73.4			12.2	31.1	16.2	59.5
90	10	158	94	13.7	53.7	15.1	82.4	130	94	13.7	34.9	18.2	66.8
	20			13.7	53.7	15.1	82.5			13.7	34.9	18.2	66.8
	30			13.7	53.7	15.1	82.6			13.7	34.9	18.2	66.9
	40			13.8	53.8	15.1	82.6			13.8	35.0	18.2	67.0
100	10	169	105	15.2	59.6	16.7	91.6	141	105	15.2	38.8	20.2	74.2
	20			15.2	59.7	16.8	91.7			15.2	38.8	20.2	74.3
	30			15.3	59.7	16.8	91.7			15.3	38.8	20.2	74.3
	40			15.3	59.7	16.8	91.8			15.3	38.9	20.3	74.4

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	.8	1.8	.8	3.4		9	6	.8	.9	.8	2.6
	20			.8	1.8	.8	3.4				.8	.9	.8	2.6
	30			.8	1.8	.8	3.4				.8	.9	.8	2.6
	40			.8	1.8	.8	3.4				.8	.9	.8	2.6
10	10	20	12	1.7	3.6	1.6	6.9		15	12	1.7	1.8	1.8	5.3
	20			1.7	3.6	1.6	7.0				1.7	1.8	1.8	5.3
	30			1.7	3.6	1.7	7.0				1.7	1.8	1.8	5.3
	40			1.7	3.7	1.7	7.0				1.7	1.8	1.8	5.3
15	10	26	18	2.5	5.5	2.6	10.5		21	18	2.5	2.7	2.7	7.9
	20			2.5	5.5	2.6	10.5				2.5	2.7	2.7	7.9
	30			2.5	5.5	2.6	10.6				2.5	2.7	2.7	7.9
	40			2.5	5.5	2.6	10.6				2.5	2.7	2.7	7.9
20	10	31	23	3.3	7.3	3.5	14.0		59	23	3.3	8.5	3.1	14.9
	20			3.3	7.3	3.5	14.1				3.3	8.5	3.1	14.9
	30			3.3	7.3	3.5	14.1				3.3	8.5	3.1	14.9
	40			3.3	7.3	3.5	14.1				3.3	8.5	3.1	14.9
25	10	37	29	4.1	9.1	4.3	17.6		65	29	4.1	10.6	3.9	18.6
	20			4.1	9.1	4.3	17.6				4.1	10.6	3.9	18.7
	30			4.2	9.1	4.3	17.6				4.2	10.6	3.9	18.7
	40			4.2	9.1	4.3	17.6				4.2	10.6	3.9	18.7
30	10	70	35	5.0	19.5	4.7	29.2		71	35	5.0	12.7	4.7	22.4
	20			5.0	19.5	4.7	29.2				5.0	12.7	4.7	22.4
	30			5.0	19.5	4.7	29.2				5.0	12.7	4.7	22.4
	40			5.0	19.5	4.7	29.2				5.0	12.7	4.7	22.4
35	10	80	40	5.8	22.8	5.5	34.0		76	40	5.8	14.8	6.6	27.2
	20			5.8	22.8	5.5	34.1				5.8	14.8	6.6	27.2
	30			5.8	22.8	5.5	34.1				5.8	14.8	6.6	27.2
	40			5.8	22.8	5.5	34.1				5.8	14.8	6.6	27.3
40	10	92	46	6.6	26.0	6.3	38.9		82	46	6.6	16.9	7.5	31.1
	20			6.6	26.0	6.3	38.9				6.6	16.9	7.5	31.1
	30			6.6	26.0	6.3	39.0				6.6	16.9	7.5	31.1
	40			6.7	26.0	6.3	39.0				6.7	16.9	7.6	31.2
45	10	104	52	7.5	29.3	7.1	43.8		88	52	7.4	19.0	8.5	35.0
	20			7.5	29.3	7.1	43.8				7.5	19.0	8.5	35.0
	30			7.5	29.3	7.1	43.8				7.5	19.1	8.5	35.0
	40			7.5	29.3	7.1	43.9				7.5	19.1	8.5	35.1
50	10	114	57	8.3	32.5	7.8	48.6		93	57	8.3	21.1	9.4	38.8
	20			8.3	32.5	7.9	48.7				8.3	21.2	9.4	38.9
	30			8.3	32.5	7.9	48.7				8.3	21.2	9.4	38.9
	40			8.3	32.6	7.9	48.7				8.3	21.2	9.4	38.9
55	10	126	63	9.1	35.8	8.6	53.5		99	63	9.1	23.3	10.4	42.7
	20			9.1	35.8	8.6	53.5				9.1	23.3	10.4	42.8
	30			9.1	35.8	8.6	53.6				9.1	23.3	10.4	42.8
	40			9.2	35.8	8.7	53.6				9.2	23.3	10.4	42.8
60	10	133	69	9.9	39.0	11.0	59.9		105	69	9.9	25.4	11.3	46.6
	20			10.0	39.0	11.0	59.9				9.9	25.4	11.3	46.7
	30			10.0	39.1	11.0	60.0				10.0	25.4	11.3	46.7
	40			10.0	39.1	11.0	60.0				10.0	25.4	11.3	46.7
70	10	144	80	11.6	45.5	12.8	69.9		116	80	11.6	29.6	15.4	56.6
	20			11.6	45.5	12.8	69.9				11.6	29.6	15.4	56.7
	30			11.6	45.6	12.8	70.0				11.6	29.6	15.4	56.7
	40			11.6	45.6	12.8	70.0				11.6	29.7	15.5	56.8
80	10	155	91	13.2	52.0	14.6	79.9		127	91	13.2	33.8	17.6	64.7
	20			13.3	52.0	14.6	79.9				13.3	33.9	17.6	64.8
	30			13.3	52.1	14.6	80.0				13.3	33.9	17.7	64.8
	40			13.3	52.1	14.6	80.0				13.3	33.9	17.7	64.9
90	10	167	103	14.9	58.5	16.4	89.9		139	103	14.9	38.1	19.8	72.8
	20			14.9	58.5	16.4	89.9				14.9	38.1	19.8	72.8
	30			15.0	58.6	16.5	90.0				14.9	38.1	19.9	72.9
	40			15.0	58.6	16.5	90.0				15.0	38.1	19.9	73.0
100	10	178	114	16.6	65.0	18.3	99.8		150	114	16.6	42.3	22.1	80.9
	20			16.6	65.1	18.3	99.9				16.6	42.3	22.1	81.0
	30			16.6	65.1	18.3	100.0				16.6	42.3	22.1	81.0
	40			16.6	65.1	18.3	100.1				16.6	42.4	22.1	81.1

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	.9	2.0	.9	3.8	10	7	.9	1.0	1.0	2.9
	20			.9	2.0	.9	3.8			.9	1.0	1.0	2.9
	30			.9	2.0	.9	3.8			.9	1.0	1.0	2.9
	40			.9	2.0	.9	3.8			.9	1.0	1.0	2.9
10	10	21	13	1.8	4.0	1.8	7.6	16	13	1.8	2.0	2.2	6.0
	20			1.8	4.0	1.8	7.6			1.8	2.0	2.2	6.0
	30			1.8	4.0	1.8	7.6			1.8	2.0	2.2	6.0
	40			1.8	4.0	1.8	7.6			1.8	2.0	2.2	6.0
15	10	27	19	2.7	6.0	2.8	11.5	55	19	2.7	7.0	2.6	12.3
	20			2.7	6.0	2.8	11.6			2.7	7.0	2.6	12.3
	30			2.7	6.0	2.8	11.6			2.7	7.0	2.6	12.3
	40			2.7	6.0	2.8	11.6			2.7	7.0	2.6	12.3
20	10	33	25	3.6	8.0	3.8	15.4	61	25	3.6	9.3	3.4	16.3
	20			3.6	8.0	3.8	15.4			3.6	9.3	3.4	16.4
	30			3.6	8.0	3.8	15.4			3.6	9.3	3.4	16.4
	40			3.6	8.0	3.8	15.4			3.6	9.3	3.4	16.4
25	10	40	32	4.5	10.0	4.7	19.2	68	32	4.5	11.6	4.3	20.4
	20			4.5	10.0	4.7	19.3			4.5	11.6	4.3	20.4
	30			4.5	10.0	4.7	19.3			4.5	11.6	4.3	20.5
	40			4.5	10.0	4.7	19.3			4.5	11.6	4.3	20.5
30	10	76	38	5.4	21.4	5.1	32.0	74	38	5.4	13.9	6.2	25.6
	20			5.4	21.5	5.1	32.0			5.4	14.0	6.2	25.6
	30			5.4	21.5	5.2	32.1			5.4	14.0	6.2	25.6
	40			5.4	21.5	5.2	32.1			5.4	14.0	6.2	25.6
35	10	88	44	6.3	25.0	6.0	37.3	80	44	6.3	16.3	7.2	29.8
	20			6.3	25.0	6.0	37.4			6.3	16.3	7.2	29.8
	30			6.3	25.0	6.0	37.4			6.3	16.3	7.2	29.9
	40			6.4	25.1	6.0	37.4			6.4	16.3	7.2	29.9
40	10	100	50	7.2	28.6	6.9	42.7	86	50	7.2	18.6	8.3	34.1
	20			7.2	28.6	6.9	42.7			7.2	18.6	8.3	34.1
	30			7.3	28.6	6.9	42.7			7.2	18.6	8.3	34.1
	40			7.3	28.6	6.9	42.8			7.3	18.6	8.3	34.2
45	10	114	57	8.1	32.2	7.7	48.0	93	57	8.1	20.9	9.3	38.3
	20			8.1	32.2	7.7	48.0			8.1	20.9	9.3	38.4
	30			8.2	32.2	7.7	48.1			8.2	20.9	9.3	38.4
	40			8.2	32.2	7.7	48.1			8.2	21.0	9.3	38.4
50	10	126	63	9.0	35.7	8.6	53.4	99	63	9.0	23.2	10.3	42.6
	20			9.1	35.8	8.6	53.4			9.0	23.3	10.3	42.6
	30			9.1	35.8	8.6	53.4			9.1	23.3	10.3	42.7
	40			9.1	35.8	8.6	53.5			9.1	23.3	10.3	42.7
55	10	133	69	9.9	39.3	11.0	60.3	105	69	9.9	25.6	11.4	46.9
	20			10.0	39.3	11.0	60.3			9.9	25.6	11.4	46.9
	30			10.0	39.4	11.0	60.3			10.0	25.6	11.4	46.9
	40			10.0	39.4	11.0	60.4			10.0	25.6	11.4	47.0
60	10	139	75	10.8	42.9	12.0	65.7	111	75	10.8	27.9	14.5	53.2
	20			10.9	42.9	12.0	65.8			10.9	27.9	14.5	53.3
	30			10.9	42.9	12.0	65.8			10.9	27.9	14.5	53.3
	40			10.9	42.9	12.0	65.9			10.9	27.9	14.5	53.4
70	10	152	88	12.7	50.0	14.0	76.7	124	88	12.6	32.5	16.9	62.1
	20			12.7	50.1	14.0	76.7			12.7	32.6	16.9	62.2
	30			12.7	50.1	14.0	76.8			12.7	32.6	17.0	62.2
	40			12.7	50.1	14.0	76.8			12.7	32.6	17.0	62.3
80	10	164	100	14.5	57.2	16.0	87.6	136	100	14.4	37.2	19.4	71.0
	20			14.5	57.2	16.0	87.7			14.5	37.2	19.4	71.1
	30			14.5	57.2	16.0	87.8			14.5	37.2	19.4	71.1
	40			14.5	57.3	16.0	87.8			14.5	37.3	19.4	71.2
90	10	177	113	16.3	64.3	18.0	98.6	149	113	16.3	41.8	21.8	79.9
	20			16.3	64.4	18.0	98.7			16.3	41.9	21.8	80.0
	30			16.3	64.4	18.0	98.7			16.3	41.9	21.8	80.0
	40			16.3	64.4	18.0	98.8			16.3	41.9	21.9	80.1
100	10	189	125	18.1	71.5	20.0	109.6	161	125	18.1	46.5	24.2	88.8
	20			18.1	71.5	20.0	109.6			18.1	46.5	24.2	88.9
	30			18.1	71.6	20.0	109.7			18.1	46.5	24.3	88.9
	40			18.2	71.6	20.0	109.8			18.1	46.6	24.3	89.0

## 280 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	.9	2.0	.9	3.8		10	7	.9	1.0	1.0	2.9
	20			.9	2.0	.9	3.8				.9	1.0	1.0	2.9
	30			.9	2.0	.9	3.8				.9	1.0	1.0	2.9
	40			.9	2.0	.9	3.8				.9	1.0	1.0	2.9
10	10	21	13	1.9	4.0	1.9	7.7		16	13	1.9	2.0	2.2	6.1
	20			1.9	4.0	1.9	7.7				1.9	2.0	2.2	6.1
	30			1.9	4.0	1.9	7.7				1.9	2.0	2.2	6.1
	40			1.9	4.0	1.9	7.7				1.9	2.0	2.2	6.1
15	10	27	19	2.8	6.0	2.9	11.7		55	19	2.8	7.0	2.7	12.4
	20			2.8	6.0	2.9	11.7				2.8	7.0	2.7	12.4
	30			2.8	6.0	2.9	11.7				2.8	7.0	2.7	12.4
	40			2.8	6.0	2.9	11.7				2.8	7.0	2.7	12.5
20	10	33	25	3.7	8.0	3.9	15.6		61	25	3.7	9.3	3.5	16.6
	20			3.7	8.0	3.9	15.6				3.7	9.3	3.5	16.6
	30			3.7	8.0	3.9	15.6				3.7	9.3	3.5	16.6
	40			3.7	8.0	3.9	15.7				3.7	9.3	3.5	16.6
25	10	40	32	4.7	10.0	4.8	19.5		68	32	4.7	11.6	4.4	20.7
	20			4.7	10.0	4.8	19.5				4.7	11.6	4.4	20.7
	30			4.7	10.0	4.8	19.5				4.7	11.6	4.4	20.7
	40			4.7	10.0	4.9	19.6				4.7	11.6	4.4	20.8
30	10	76	38	5.6	21.5	5.3	32.4		74	38	5.6	14.0	6.3	25.8
	20			5.6	21.5	5.3	32.4				5.6	14.0	6.3	25.9
	30			5.6	21.5	5.3	32.4				5.6	14.0	6.3	25.9
	40			5.6	21.5	5.3	32.4				5.6	14.0	6.3	25.9
35	10	88	44	6.5	25.0	6.2	37.7		80	44	6.5	16.3	7.3	30.1
	20			6.5	25.0	6.2	37.8				6.5	16.3	7.4	30.2
	30			6.5	25.0	6.2	37.8				6.5	16.3	7.4	30.2
	40			6.5	25.1	6.2	37.8				6.5	16.3	7.4	30.2
40	10	100	50	7.5	28.6	7.1	43.1		86	50	7.4	18.6	8.4	34.4
	20			7.5	28.6	7.1	43.2				7.5	18.6	8.4	34.5
	30			7.5	28.6	7.1	43.2				7.5	18.6	8.4	34.5
	40			7.5	28.6	7.1	43.2				7.5	18.6	8.4	34.5
45	10	114	57	8.4	32.2	8.0	48.5		93	57	8.4	20.9	9.4	38.8
	20			8.4	32.2	8.0	48.6				8.4	20.9	9.5	38.8
	30			8.4	32.2	8.0	48.6				8.4	21.0	9.5	38.8
	40			8.4	32.2	8.0	48.6				8.4	21.0	9.5	38.8
50	10	126	63	9.3	35.8	8.9	53.9		99	63	9.3	23.3	10.5	43.1
	20			9.3	35.8	8.9	54.0				9.3	23.3	10.5	43.1
	30			9.3	35.8	8.9	54.0				9.3	23.3	10.5	43.1
	40			9.4	35.8	8.9	54.0				9.4	23.3	10.5	43.2
55	10	133	69	10.3	39.3	11.2	60.8		105	69	10.2	25.6	11.5	47.4
	20			10.3	39.3	11.2	60.8				10.3	25.6	11.6	47.4
	30			10.3	39.4	11.2	60.9				10.3	25.6	11.6	47.4
	40			10.3	39.4	11.2	60.9				10.3	25.6	11.6	47.5
60	10	139	75	11.2	42.9	12.2	66.3		111	75	11.2	27.9	14.6	53.7
	20			11.2	42.9	12.2	66.4				11.2	27.9	14.6	53.7
	30			11.2	42.9	12.2	66.4				11.2	27.9	14.6	53.8
	40			11.2	43.0	12.3	66.4				11.2	28.0	14.6	53.8
70	10	152	88	13.0	50.1	14.3	77.4		124	88	13.0	32.6	17.0	62.6
	20			13.1	50.1	14.3	77.4				13.1	32.6	17.0	62.7
	30			13.1	50.1	14.3	77.5				13.1	32.6	17.1	62.7
	40			13.1	50.1	14.3	77.5				13.1	32.6	17.1	62.8
80	10	164	100	14.9	57.2	16.3	88.4		136	100	14.9	37.2	19.5	71.6
	20			14.9	57.2	16.3	88.5				14.9	37.2	19.5	71.6
	30			15.0	57.3	16.3	88.5				14.9	37.2	19.5	71.7
	40			15.0	57.3	16.3	88.6				15.0	37.3	19.5	71.7
90	10	177	113	16.8	64.4	18.3	99.5		149	113	16.8	41.9	21.9	80.5
	20			16.8	64.4	18.4	99.5				16.8	41.9	21.9	80.6
	30			16.8	64.4	18.4	99.6				16.8	41.9	22.0	80.7
	40			16.8	64.4	18.4	99.7				16.8	41.9	22.0	80.7
100	10	189	125	18.6	71.5	20.4	110.5		161	125	18.6	46.5	24.4	89.5
	20			18.7	71.5	20.4	110.6				18.6	46.5	24.4	89.6
	30			18.7	71.6	20.4	110.7				18.7	46.6	24.4	89.6
	40			18.7	71.6	20.4	110.7				18.7	46.6	24.4	89.7



## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	1.0	2.2	1.0	4.2	10	7	1.0	1.1	1.1	3.2
	40			1.0	2.2	1.0	4.2			1.0	1.1	1.1	3.2
	60			1.0	2.2	1.0	4.2			1.0	1.1	1.1	3.2
	80			1.0	2.2	1.0	4.2			1.0	1.1	1.1	3.2
10	20	22	14	2.0	4.4	2.0	8.5	17	14	2.0	2.2	2.4	6.7
	40			2.0	4.5	2.0	8.5			2.0	2.2	2.4	6.7
	60			2.0	4.5	2.0	8.5			2.0	2.2	2.4	6.7
	80			2.1	4.5	2.0	8.6			2.1	2.2	2.4	6.7
15	20	29	21	3.1	6.7	3.2	12.9	57	21	3.1	7.7	2.9	13.7
	40			3.1	6.7	3.2	12.9			3.1	7.8	2.9	13.7
	60			3.1	6.7	3.2	13.0			3.1	7.8	2.9	13.8
	80			3.1	6.7	3.2	13.0			3.1	7.8	2.9	13.8
20	20	36	28	4.1	8.9	4.2	17.2	64	28	4.1	10.3	3.9	18.3
	40			4.1	8.9	4.3	17.3			4.1	10.3	3.9	18.3
	60			4.1	8.9	4.3	17.3			4.1	10.4	3.9	18.3
	80			4.1	8.9	4.3	17.3			4.1	10.4	3.9	18.4
25	20	70	35	5.1	19.9	4.8	29.8	71	35	5.1	12.9	4.8	22.8
	40			5.1	19.9	4.8	29.8			5.1	12.9	4.8	22.9
	60			5.1	19.9	4.9	29.9			5.1	12.9	4.9	22.9
	80			5.1	19.9	4.9	29.9			5.1	13.0	4.9	23.0
30	20	84	42	6.1	23.8	5.8	35.8	78	42	6.1	15.5	6.9	28.5
	40			6.1	23.8	5.8	35.8			6.1	15.5	6.9	28.6
	60			6.1	23.9	5.8	35.8			6.1	15.5	7.0	28.6
	80			6.2	23.9	5.8	35.9			6.2	15.6	7.0	28.7
35	20	98	49	7.1	27.8	6.8	41.7	85	49	7.1	18.1	8.1	33.3
	40			7.2	27.8	6.8	41.8			7.1	18.1	8.1	33.4
	60			7.2	27.8	6.8	41.8			7.2	18.1	8.1	33.4
	80			7.2	27.9	6.8	41.9			7.2	18.1	8.1	33.5
40	20	112	56	8.2	31.8	7.7	47.7	92	56	8.1	20.7	9.2	38.1
	40			8.2	31.8	7.8	47.7			8.2	20.7	9.3	38.1
	60			8.2	31.8	7.8	47.8			8.2	20.7	9.3	38.2
	80			8.2	31.9	7.8	47.8			8.2	20.7	9.3	38.2
45	20	126	63	9.2	35.7	8.7	53.6	99	63	9.2	23.2	10.4	42.8
	40			9.2	35.8	8.7	53.7			9.2	23.3	10.4	42.9
	60			9.2	35.8	8.7	53.8			9.2	23.3	10.4	42.9
	80			9.2	35.8	8.7	53.8			9.2	23.3	10.4	43.0
50	20	134	70	10.2	39.7	11.2	61.1	106	70	10.2	25.8	11.6	47.6
	40			10.2	39.7	11.2	61.2			10.2	25.9	11.6	47.6
	60			10.2	39.8	11.2	61.3			10.2	25.9	11.6	47.7
	80			10.3	39.8	11.3	61.3			10.3	25.9	11.6	47.8
55	20	141	77	11.2	43.7	12.3	67.2	113	77	11.2	28.4	14.8	54.4
	40			11.2	43.7	12.3	67.3			11.2	28.4	14.8	54.5
	60			11.3	43.8	12.4	67.4			11.3	28.5	14.9	54.6
	80			11.3	43.8	12.4	67.5			11.3	28.5	14.9	54.7
60	20	148	84	12.2	47.7	13.4	73.3	120	84	12.2	31.0	16.2	59.4
	40			12.3	47.7	13.5	73.4			12.3	31.0	16.2	59.5
	60			12.3	47.7	13.5	73.5			12.3	31.1	16.2	59.6
	80			12.3	47.8	13.5	73.6			12.3	31.1	16.2	59.7
70	20	162	98	14.3	55.6	15.7	85.6	134	98	14.3	36.2	18.9	69.3
	40			14.3	55.6	15.7	85.7			14.3	36.2	18.9	69.4
	60			14.3	55.7	15.7	85.8			14.3	36.2	18.9	69.5
	80			14.4	55.7	15.8	85.9			14.4	36.3	18.9	69.6
80	20	176	112	16.3	63.5	17.9	97.8	148	112	16.3	41.3	21.6	79.2
	40			16.3	63.6	18.0	97.9			16.3	41.4	21.6	79.3
	60			16.4	63.6	18.0	98.0			16.4	41.4	21.6	79.5
	80			16.4	63.7	18.0	98.1			16.4	41.5	21.7	79.6
90	20	189	125	18.3	71.5	20.2	110.0	161	125	18.3	46.5	24.3	89.1
	40			18.4	71.5	20.2	110.1			18.4	46.5	24.3	89.2
	60			18.4	71.6	20.2	110.3			18.4	46.6	24.4	89.4
	80			18.5	71.7	20.3	110.4			18.5	46.7	24.4	89.5
100	20	203	139	20.4	79.4	25.5	125.3	175	139	20.4	51.7	27.0	99.0
	40			20.4	79.5	25.6	125.5			20.4	51.7	27.0	99.2
	60			20.5	79.6	25.6	125.6			20.5	51.8	27.1	99.3
	80			20.5	79.6	25.6	125.8			20.5	51.8	27.1	99.5

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	1.3	2.9	1.3	5.5	12	9	1.3	1.4	1.4	4.2
	40			1.3	2.9	1.3	5.5			1.3	1.4	1.4	4.2
	60			1.3	2.9	1.3	5.5			1.3	1.4	1.4	4.2
	80			1.3	2.9	1.3	5.5			1.3	1.4	1.4	4.2
10	20	26	18	2.7	5.7	2.8	11.1	21	18	2.6	2.9	2.8	8.3
	40			2.7	5.7	2.8	11.1			2.7	2.9	2.8	8.3
	60			2.7	5.7	2.8	11.2			2.7	2.9	2.8	8.4
	80			2.7	5.7	2.8	11.2			2.7	2.9	2.8	8.4
15	20	35	27	4.0	8.6	4.1	16.7	63	27	4.0	10.0	3.8	17.7
	40			4.0	8.6	4.1	16.7			4.0	10.0	3.8	17.7
	60			4.0	8.6	4.2	16.7			4.0	10.0	3.8	17.8
	80			4.0	8.6	4.2	16.8			4.0	10.0	3.8	17.8
20	20	72	36	5.3	20.4	5.1	30.7	72	36	5.3	13.3	5.1	23.6
	40			5.3	20.4	5.1	30.8			5.3	13.3	5.1	23.6
	60			5.3	20.4	5.1	30.8			5.3	13.3	5.1	23.7
	80			5.3	20.4	5.1	30.8			5.3	13.3	5.1	23.7
25	20	90	45	6.6	25.5	6.3	38.4	81	45	6.6	16.6	7.5	30.7
	40			6.6	25.5	6.3	38.5			6.6	16.6	7.5	30.7
	60			6.7	25.5	6.3	38.5			6.6	16.6	7.5	30.8
	80			6.7	25.5	6.3	38.5			6.7	16.6	7.5	30.8
30	20	108	54	8.0	30.6	7.6	46.1	90	54	7.9	19.9	9.0	36.8
	40			8.0	30.6	7.6	46.2			8.0	19.9	9.0	36.9
	60			8.0	30.6	7.6	46.2			8.0	19.9	9.0	36.9
	80			8.0	30.7	7.6	46.3			8.0	20.0	9.0	37.0
35	20	126	63	9.3	35.7	8.8	53.8	99	63	9.3	23.2	10.5	43.0
	40			9.3	35.7	8.9	53.9			9.3	23.2	10.5	43.0
	60			9.3	35.7	8.9	53.9			9.3	23.3	10.5	43.1
	80			9.3	35.8	8.9	54.0			9.3	23.3	10.5	43.1
40	20	136	72	10.6	40.8	11.6	63.0	108	72	10.6	26.5	12.0	49.1
	40			10.6	40.8	11.6	63.1			10.6	26.6	12.0	49.2
	60			10.6	40.8	11.6	63.1			10.6	26.6	12.0	49.2
	80			10.7	40.9	11.7	63.2			10.7	26.6	12.0	49.3
45	20	145	81	11.9	45.9	13.1	70.9	117	81	11.9	29.9	15.6	57.4
	40			12.0	45.9	13.1	71.0			11.9	29.9	15.6	57.4
	60			12.0	46.0	13.1	71.0			12.0	29.9	15.6	57.5
	80			12.0	46.0	13.1	71.1			12.0	29.9	15.7	57.6
50	20	154	90	13.3	51.0	14.5	78.8	126	90	13.2	33.2	17.3	63.7
	40			13.3	51.0	14.5	78.8			13.3	33.2	17.4	63.8
	60			13.3	51.1	14.6	78.9			13.3	33.2	17.4	63.9
	80			13.3	51.1	14.6	79.0			13.3	33.3	17.4	64.0
55	20	163	99	14.6	56.1	16.0	86.6	135	99	14.6	36.5	19.1	70.1
	40			14.6	56.1	16.0	86.7			14.6	36.5	19.1	70.2
	60			14.6	56.2	16.0	86.8			14.6	36.6	19.1	70.3
	80			14.7	56.2	16.0	86.9			14.7	36.6	19.1	70.4
60	20	172	108	15.9	61.2	17.4	94.5	144	108	15.9	39.8	20.8	76.5
	40			15.9	61.2	17.4	94.6			15.9	39.8	20.8	76.6
	60			16.0	61.3	17.5	94.7			16.0	39.9	20.8	76.7
	80			16.0	61.3	17.5	94.8			16.0	39.9	20.9	76.8
70	20	189	125	18.6	71.4	20.3	110.3	161	125	18.5	46.4	24.3	89.3
	40			18.6	71.4	20.4	110.4			18.6	46.5	24.3	89.4
	60			18.6	71.5	20.4	110.5			18.6	46.5	24.4	89.5
	80			18.7	71.5	20.4	110.6			18.7	46.6	24.4	89.6
80	20	207	143	21.2	81.6	26.3	129.1	179	143	21.2	53.1	27.8	102.1
	40			21.2	81.6	26.4	129.2			21.2	53.1	27.8	102.2
	60			21.3	81.7	26.4	129.4			21.3	53.2	27.9	102.3
	80			21.3	81.8	26.4	129.5			21.3	53.2	27.9	102.4
90	20	225	161	23.9	91.8	29.6	145.2	197	161	23.8	59.7	39.8	123.3
	40			23.9	91.8	29.6	145.4			23.9	59.8	39.8	123.5
	60			23.9	91.9	29.7	145.5			23.9	59.8	39.9	123.6
	80			24.0	92.0	29.7	145.7			24.0	59.9	39.9	123.8
100	20	243	179	26.5	102.0	32.9	161.4	215	179	26.5	66.3	44.2	137.0
	40			26.6	102.0	32.9	161.5			26.5	66.4	44.3	137.2
	60			26.6	102.1	33.0	161.7			26.6	66.5	44.3	137.4
	80			26.6	102.2	33.0	161.9			26.6	66.5	44.4	137.5

## 500 CHARACTER DATA RECORD

7010/1302 DISK

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CH LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	1.8	4.0	1.8	7.5		16	13	1.8	2.0	2.1	5.9
	40			1.8	4.0	1.8	7.5				1.8	2.0	2.2	5.9
	60			1.8	4.0	1.8	7.5				1.8	2.0	2.2	5.9
	80			1.8	4.0	1.8	7.5				1.8	2.0	2.2	5.9
10	20	33	25	3.5	8.0	3.7	15.2		61	25	3.5	9.3	3.4	16.2
	40			3.5	8.0	3.7	15.2				3.5	9.3	3.4	16.2
	60			3.5	8.0	3.7	15.3				3.5	9.3	3.4	16.2
	80			3.5	8.0	3.7	15.3				3.5	9.3	3.4	16.2
15	20	76	38	5.3	21.3	5.0	31.7		74	38	5.3	13.9	6.1	25.3
	40			5.3	21.4	5.1	31.7				5.3	13.9	6.1	25.3
	60			5.3	21.4	5.1	31.7				5.3	13.9	6.1	25.3
	80			5.3	21.4	5.1	31.8				5.3	13.9	6.1	25.4
20	20	100	50	7.1	28.5	6.7	42.3		86	50	7.1	18.5	8.1	33.7
	40			7.1	28.5	6.7	42.3				7.1	18.5	8.1	33.8
	60			7.1	28.5	6.7	42.3				7.1	18.6	8.2	33.8
	80			7.1	28.5	6.8	42.4				7.1	18.6	8.2	33.8
25	20	126	63	8.8	35.6	8.4	52.8		99	63	8.8	23.2	10.2	42.2
	40			8.8	35.6	8.4	52.9				8.8	23.2	10.2	42.2
	60			8.8	35.6	8.4	52.9				8.8	23.2	10.2	42.2
	80			8.9	35.6	8.4	52.9				8.9	23.2	10.2	42.3
30	20	139	75	10.6	42.7	11.8	65.1		111	75	10.6	27.8	14.4	52.8
	40			10.6	42.7	11.8	65.1				10.6	27.8	14.4	52.8
	60			10.6	42.7	11.8	65.2				10.6	27.8	14.4	52.9
	80			10.6	42.8	11.8	65.3				10.6	27.9	14.4	52.9
35	20	152	88	12.4	49.8	13.8	75.9		124	88	12.3	32.4	16.8	61.6
	40			12.4	49.8	13.8	76.0				12.4	32.5	16.8	61.6
	60			12.4	49.9	13.8	76.1				12.4	32.5	16.8	61.7
	80			12.4	49.9	13.8	76.1				12.4	32.5	16.8	61.7
40	20	164	100	14.1	56.9	15.7	86.8		136	100	14.1	37.1	19.2	70.4
	40			14.1	57.0	15.8	86.9				14.1	37.1	19.2	70.4
	60			14.2	57.0	15.8	86.9				14.1	37.1	19.2	70.5
	80			14.2	57.0	15.8	87.0				14.2	37.2	19.2	70.6
45	20	177	113	15.9	64.0	17.7	97.6		149	113	15.9	41.7	21.7	79.2
	40			15.9	64.1	17.7	97.7				15.9	41.7	21.7	79.3
	60			15.9	64.1	17.7	97.8				15.9	41.8	21.7	79.4
	80			15.9	64.2	17.8	97.9				15.9	41.8	21.7	79.5
50	20	189	125	17.7	71.2	19.7	108.5		161	125	17.6	46.3	24.1	88.0
	40			17.7	71.2	19.7	108.6				17.7	46.4	24.1	88.1
	60			17.7	71.2	19.7	108.7				17.7	46.4	24.1	88.2
	80			17.7	71.3	19.7	108.8				17.7	46.4	24.1	88.3
55	20	202	138	19.4	78.3	24.9	122.6		174	138	19.4	51.0	26.5	96.8
	40			19.4	78.3	24.9	122.7				19.4	51.0	26.5	96.9
	60			19.5	78.4	25.0	122.8				19.5	51.0	26.5	97.0
	80			19.5	78.4	25.0	122.9				19.5	51.1	26.5	97.1
60	20	214	150	21.2	85.4	27.2	133.7		186	150	21.2	55.6	37.6	114.4
	40			21.2	85.4	27.2	133.8				21.2	55.6	37.6	114.5
	60			21.2	85.5	27.2	134.0				21.2	55.7	37.7	114.6
	80			21.3	85.6	27.3	134.1				21.3	55.7	37.7	114.7
65	20	227	163	22.9	92.5	29.4	144.9		199	163	22.9	60.2	40.7	123.9
	40			23.0	92.6	29.5	145.0				23.0	60.3	40.8	124.0
	60			23.0	92.6	29.5	145.1				23.0	60.3	40.8	124.1
	80			23.0	92.7	29.5	145.2				23.0	60.4	40.9	124.2
70	20	239	175	24.7	99.6	31.7	156.0		211	175	24.7	64.9	43.9	133.4
	40			24.7	99.7	31.7	156.2				24.7	64.9	43.9	133.6
	60			24.8	99.7	31.8	156.3				24.8	65.0	44.0	133.7
	80			24.8	99.8	31.8	156.4				24.8	65.0	44.0	133.8
75	20	247	192	26.5	106.7	34.0	167.2		224	188	26.5	69.5	47.0	143.0
	40			26.5	106.8	34.0	167.3				26.5	69.5	47.1	143.1
	60			26.5	106.9	34.0	167.4				26.5	69.6	47.1	143.2
	80			26.6	106.9	34.1	167.6				26.6	69.7	47.1	143.4

## 750 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	2.8	6.6	3.0	12.4		57	21	2.8	7.7	2.7	13.2
	40			2.8	6.6	3.0	12.4				2.8	7.7	2.7	13.2
	60			2.8	6.6	3.0	12.4				2.8	7.7	2.7	13.2
	80			2.8	6.6	3.0	12.5				2.8	7.7	2.7	13.2
10	20	84	42	5.6	23.5	5.4	34.5		78	42	5.6	15.4	6.6	27.6
	40			5.6	23.6	5.4	34.6				5.6	15.4	6.6	27.6
	60			5.6	23.6	5.4	34.6				5.6	15.4	6.6	27.6
	80			5.6	23.6	5.4	34.6				5.6	15.4	6.6	27.6
15	20	126	63	8.4	35.3	8.1	51.8		99	63	8.4	23.0	9.9	41.3
	40			8.4	35.3	8.1	51.8				8.4	23.1	9.9	41.4
	60			8.5	35.4	8.1	51.9				8.4	23.1	9.9	41.4
	80			8.5	35.4	8.1	51.9				8.5	23.1	9.9	41.4
20	20	148	84	11.3	47.1	12.7	71.0		120	84	11.2	30.7	15.8	57.7
	40			11.3	47.1	12.7	71.1				11.3	30.7	15.8	57.8
	60			11.3	47.1	12.7	71.1				11.3	30.8	15.8	57.8
	80			11.3	47.2	12.7	71.2				11.3	30.8	15.8	57.9
25	20	169	105	14.1	58.9	15.9	88.8		141	105	14.1	38.4	19.7	72.2
	40			14.1	58.9	15.9	88.9				14.1	38.4	19.7	72.2
	60			14.1	58.9	15.9	88.9				14.1	38.5	19.7	72.3
	80			14.1	59.0	15.9	89.0				14.1	38.5	19.7	72.3
30	20	189	125	16.9	70.6	19.1	106.6		161	125	16.9	46.1	23.8	86.7
	40			16.9	70.7	19.1	106.6				16.9	46.1	23.8	86.8
	60			16.9	70.7	19.1	106.7				16.9	46.2	23.8	86.9
	80			16.9	70.8	19.1	106.8				16.9	46.2	23.8	86.9
40	20	231	167	22.5	94.2	29.6	146.3		203	167	22.5	61.5	42.2	126.1
	40			22.5	94.2	29.7	146.4				22.5	61.5	42.2	126.2
	60			22.5	94.3	29.7	146.5				22.5	61.5	42.2	126.3
	80			22.6	94.3	29.7	146.6				22.5	61.6	42.3	126.4
45	20	250	192	25.5	106.8	33.6	165.9		225	189	25.5	69.7	47.8	143.0
	40			25.5	106.9	33.6	166.0				25.5	69.7	47.9	143.1
	60			25.6	106.9	33.7	166.1				25.5	69.8	47.9	143.2
	80			25.6	107.0	33.7	166.2				25.6	69.8	47.9	143.3

## 1000 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	40	32	4.0	9.9	4.3	18.3		68	32	4.0	11.4	3.8	19.3
	40			4.0	9.9	4.3	18.3				4.0	11.4	3.9	19.3
	60			4.0	9.9	4.3	18.3				4.0	11.4	3.9	19.3
	80			4.0	9.9	4.3	18.3				4.0	11.4	3.9	19.3
10	20	126	63	8.1	34.9	7.7	50.6		99	63	8.1	22.9	9.5	40.4
	40			8.1	34.9	7.7	50.7				8.1	22.9	9.5	40.4
	60			8.1	34.9	7.7	50.7				8.1	22.9	9.5	40.5
	80			8.1	34.9	7.7	50.7				8.1	22.9	9.5	40.5
15	20	158	94	12.1	52.3	13.7	78.2		130	94	12.1	34.3	17.3	63.7
	40			12.1	52.3	13.8	78.2				12.1	34.3	17.4	63.8
	60			12.1	52.3	13.8	78.2				12.1	34.3	17.4	63.8
	80			12.1	52.4	13.8	78.3				12.1	34.3	17.4	63.8
20	20	189	125	16.2	69.7	18.3	104.2		161	125	16.1	45.7	23.4	85.2
	40			16.2	69.8	18.3	104.3				16.1	45.7	23.4	85.3
	60			16.2	69.8	18.4	104.3				16.2	45.8	23.4	85.3
	80			16.2	69.8	18.4	104.4				16.2	45.8	23.5	85.4
25	20	221	157	20.2	87.2	27.1	134.4		193	157	20.2	57.1	39.7	117.0
	40			20.2	87.2	27.1	134.5				20.2	57.2	39.7	117.1
	60			20.2	87.2	27.1	134.6				20.2	57.2	39.7	117.1
	80			20.2	87.3	27.1	134.6				20.2	57.2	39.8	117.2
30	20	247	192	24.2	104.6	32.5	161.3		224	188	24.2	68.6	47.6	140.4
	40			24.2	104.6	32.5	161.4				24.2	68.6	47.7	140.5
	60			24.2	104.7	32.5	161.5				24.2	68.6	47.7	140.5
	80			24.3	104.8	32.6	161.6				24.2	68.7	47.7	140.6

## 1500 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	1.5	3.7	1.4	6.5		16	13	1.5	1.8	1.4	4.7
	40			1.5	3.7	1.4	6.5				1.5	1.8	1.4	4.7
	60			1.5	3.7	1.4	6.5				1.5	1.8	1.4	4.7
	80			1.5	3.7	1.4	6.5				1.5	1.8	1.4	4.7
2	20	33	25	2.9	7.3	2.8	13.1		61	25	2.9	7.3	2.8	13.1
	40			2.9	7.3	2.8	13.1				2.9	7.3	2.8	13.1
	60			2.9	7.3	2.8	13.1				2.9	7.3	2.8	13.1
	80			2.9	7.3	2.8	13.1				2.9	7.3	2.8	13.1
3	20	76	38	4.4	16.5	4.2	25.1		74	38	4.4	11.0	4.2	19.6
	40			4.4	16.5	4.2	25.1				4.4	11.0	4.2	19.6
	60			4.4	16.5	4.2	25.1				4.4	11.0	4.2	19.6
	80			4.4	16.5	4.2	25.1				4.4	11.0	4.2	19.6
4	20	100	50	5.9	21.9	5.6	33.4		86	50	5.9	14.6	5.6	26.1
	40			5.9	22.0	5.6	33.4				5.9	14.6	5.6	26.1
	60			5.9	22.0	5.6	33.5				5.9	14.6	5.6	26.1
	80			5.9	22.0	5.6	33.5				5.9	14.7	5.6	26.2
5	20	126	63	7.4	27.4	7.0	41.8		99	63	7.4	18.3	7.0	32.6
	40			7.4	27.4	7.0	41.8				7.4	18.3	7.0	32.7
	60			7.4	27.5	7.0	41.8				7.4	18.3	7.0	32.7
	80			7.4	27.5	7.0	41.9				7.4	18.3	7.0	32.7
10	20	189	125	14.7	54.8	14.0	83.6		161	125	14.7	36.6	14.0	65.3
	40			14.7	54.9	14.0	83.6				14.7	36.6	14.0	65.3
	60			14.7	54.9	14.0	83.7				14.7	36.6	14.0	65.4
	80			14.7	55.0	14.0	83.7				14.7	36.6	14.0	65.4
15	20	247	192	22.1	82.3	21.0	125.4		224	188	22.1	54.8	21.0	97.9
	40			22.1	82.3	21.0	125.4				22.1	54.9	21.0	98.0
	60			22.1	82.4	21.0	125.5				22.1	54.9	21.0	98.0
	80			22.1	82.4	21.1	125.6				22.1	55.0	21.1	98.1

## 2000 CHARACTER DATA RECORD

7010/1302 DISK INPUT AND OUTPUT 729 IV TAPES - 556 CPI

## 60K CORE STORAGE

## 80/100K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES					CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	1.6	3.7	1.5	6.8		16	13	1.6	1.8	1.5	5.0
	40			1.6	3.7	1.5	6.8				1.6	1.8	1.5	5.0
	60			1.6	3.7	1.5	6.8				1.6	1.8	1.5	5.0
	80			1.6	3.7	1.5	6.8				1.6	1.8	1.5	5.0
2	20	33	25	3.2	7.3	3.1	13.6		61	25	3.2	7.3	3.1	13.6
	40			3.2	7.3	3.1	13.6				3.2	7.3	3.1	13.6
	60			3.2	7.3	3.1	13.6				3.2	7.3	3.1	13.6
	80			3.2	7.3	3.1	13.7				3.2	7.3	3.1	13.6
3	20	76	38	4.8	16.5	4.6	25.9		74	38	4.8	11.0	4.6	20.4
	40			4.8	16.5	4.6	26.0				4.8	11.0	4.6	20.5
	60			4.8	16.5	4.6	26.0				4.8	11.0	4.6	20.5
	80			4.8	16.5	4.6	26.0				4.8	11.0	4.6	20.5
4	20	100	50	6.5	22.0	6.2	34.6		86	50	6.4	14.7	6.2	27.3
	40			6.5	22.0	6.2	34.6				6.4	14.7	6.2	27.3
	60			6.5	22.0	6.2	34.6				6.4	14.7	6.2	27.3
	80			6.5	22.0	6.2	34.6				6.4	14.7	6.2	27.3
5	20	126	63	8.1	27.5	7.7	43.2		99	63	8.1	18.3	7.7	34.1
	40			8.1	27.5	7.7	43.3				8.1	18.3	7.7	34.1
	60			8.1	27.5	7.7	43.3				8.1	18.3	7.7	34.1
	80			8.1	27.5	7.7	43.3				8.1	18.4	7.7	34.1
10	20	189	125	16.1	54.9	15.4	86.5		161	125	16.1	36.6	15.4	68.1
	40			16.1	55.0	15.4	86.5				16.1	36.7	15.4	68.2
	60			16.1	55.0	15.4	86.6				16.1	36.7	15.4	68.2
	80			16.1	55.1	15.4	86.6				16.1	36.7	15.4	68.3
15	20	247	192	24.2	82.4	23.1	101.7		224	188	24.2	54.9	23.1	102.2
	40			24.2	82.5	23.1	129.8				24.2	55.0	23.1	102.3
	60			24.2	82.5	23.1	129.9				24.2	55.0	23.1	102.3
	80			24.2	82.6	23.1	129.9				24.2	55.1	23.1	102.4

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## Technical Newsletter

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Re: Form No. C28-0404-1

This Newsletter No. N27-1254

Date September 8, 1966

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IBM 1410/7010 GENERALIZED SORT PROGRAM  
USING IBM 1301/2302 DISK STORAGE

This Technical Newsletter amends the publication "IBM 1410/7010 Operating System; Generalized Sorting Program Using IBM 1301/2302 Disk Storage," Form C28-0404-1, to add instructions for the deletion of Form 1, 2, 3, and 4 records from the sort in Phase 3 Exit Points, and to make other necessary changes and additions to the publication.

The attached replacement pages (25-26, 31-32, 59-62, 65-66, and 71-72) should be substituted for the corresponding pages now in the manual. Text changes are indicated by a vertical bar to the left of the affected text.

The following changes should also be made in the publication:

<u>Page</u>	<u>Amendment</u>
67	In the right column, under the heading Memory-to-Memory Merge Time ( $T_3$ ), change the figure 899 to read:  .899
73	In the left column, under MEANING, change the last word in the first sentence from "stored" to:  sorted

Please file this cover letter at the back of the manual. It provides a method of determining if all changes have been received and incorporated into the publication.



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File Number 1410/7010-33  
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IBM 1410/7010 GENERALIZED SORT PROGRAM  
USING IBM 1301/2302 DISK STORAGE

This Technical Newsletter amends the publication "IBM 1410/7010 Operating System; Generalized Sorting Program Using IBM 1301/2302 Disk Storage," Form C28-0404-1, to indicate the use of "primes" within equations.

The attached replacement pages, 71-72, should be substituted for the corresponding pages currently in the manual. Text changes are indicated by vertical bars at the left of the affected text.

Please file this cover letter at the back of the manual. It provides a method of determining if all changes have been received and incorporated into the publication.



International Business Machines Corporation  
Data Processing Division  
112 East Post Road, White Plains, N. Y. 10601